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CHARLES ALFRED WEATHERBY
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STUART KIMBALL HARRIS
} Associate Editors

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RHODORA.—A monthly journal of botany, devoted primarily to the flora of New England. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) 20 cents. Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application. Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

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MONOGRAPHIC STUDIES IN THE GENUS ELEOCHARIS—V[1]

H. K. Svenson

(Plates 537–547)

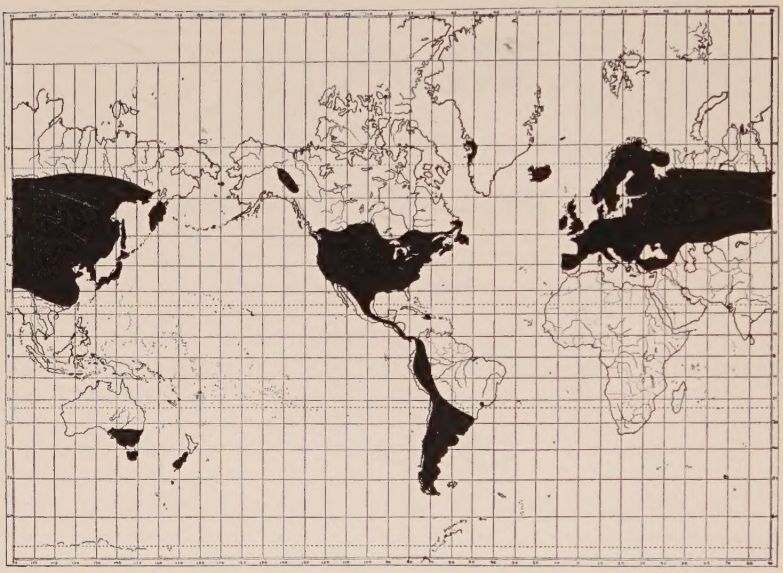
This paper, concluding the purely taxonomic treatment of *Eleocharis*, includes species not previously or adequately discussed, together with illustrations, distributional maps, and indexes to all species.

Since my initial treatment of the genus, I have seen most of the additional large collections of *Eleocharis* in this country, and during two visits to Europe, I was able to find many of the types which could not otherwise be interpreted. To all who have lent me material for study and to those who have given me access to collections, I offer my deep appreciation.

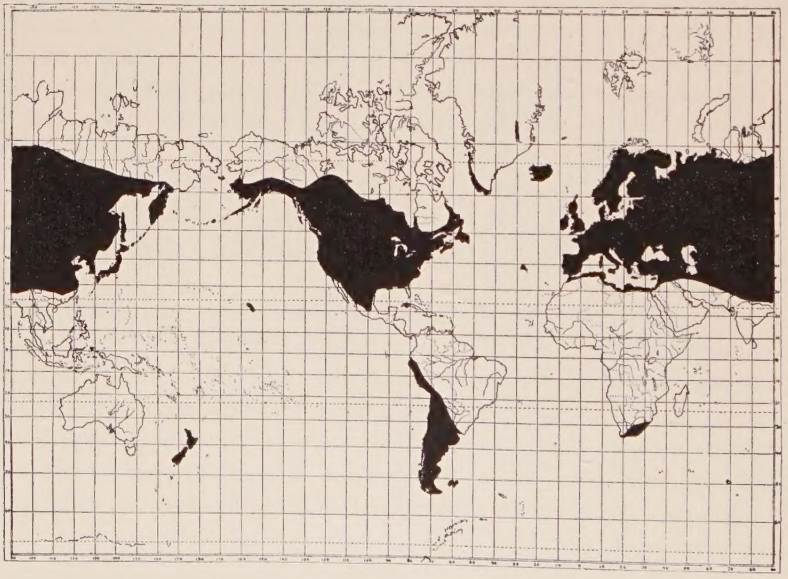
To the groups into which the genus has been divided (Rhodora xxxi. 127–129 (1929), the old-world *Multicaules* have been added; the incongruous series *Intermediae*, *Melanocarpeae* and *Tuberculosae* have been eliminated.

As to the relationships of *Eleocharis*, little can be said here. It is a "natural" genus, probably most closely allied to *Fimbristylis*, as Chermezon has pointed out. From species of *Scirpus* (i.e. *S. cespitosus*, *S. pumilus*, *S. planifolius*, etc.) there is a marked cleavage in the texture of the achene and especially in the type of cellular reticulation, the most important single character for determination of species in *Eleocharis*. As discussed under the *Palustres*, the relative width or constriction of the tubercle, the nature of the sheath-apex, or the

[1] Brooklyn Botanic Garden Contributions no. 85. The cost of plates and maps is met by the Brooklyn Botanic Garden.



MAP 1. Range of ELEOCHARIS, series ACICULARES.



MAP 2. Range of ELEOCHARIS, subseries PALUSTRES.

uniglumate condition of the lowest scale are not always dependable characters.

Eleocharis: Conspectus of the Genus

Series 1. Mutatae.

1, E. fistulosa. 2, E. nupeensis. 3, E. quadrangulata. 4, E. mutata. 5, E. cellulosa. 6, E. variegata. 7, E. laxiflora. 8, E. nuda. 9, E. calocarpa. 10, E. spiralis. 11, E. interstincta. 12, E. equisetoides. 13, E. dulcis. 14, E. sphacelata. 15, E. Robbinsii. 16, E. elongata. 17, E. mitrata. 18, E. Jelskiana. 19, E. plicarhachis.

Series 2. Pauciflorae.

20, E. pauciflora. 21, E. macrantha. 22, E. margaritacea. 23, E. parvula. 24, E. rostellata. 25, E. melanomphala.

Series 3. Aciculares.

26, E. exigua. 27, E. radicans. 28, E. bonariensis. 29, E. stenocarpa. 30, E. nervata. 31, E. brachycarpa. 32, E. cancellata. 33, E. bella. 34, E. Reverchonii. 35, E. Wolfii. 36, E. acicularis. 37, E. pusilla.

Series 4. Ovatae.

38, E. obtusa. 39, E. ovata. 40, E. Engelmanni. 41, E. lanceolata.

Series 5. Maculosae.

42, E. maculosa. 43, E. fuscopurpurea. 44, E. debilis. 45, E. bahamensis. 46, E. atropurpurea. 47, E. capillacea. 48, E. Sellowiana. 49, E. Schaffneri. 50, E. olivacea. 51, E. flavescens. 52, E. Sintenisii. 53, E. geniculata. 54, E. minuta. 55, E. intricata.

Series 6. Palustriformes.

Sub-series: Palustres.

56, E. palustris. 57, E. mamillata. 58, E. macrostachya. 59, E. neozeylandica. 60, E. melanostachys. 61, E. Dregeana. 62, E. mitracarpa. 63, E. Savatieri. 64, E. calva. 65, E. Smallii. 66, E. ambigens. 67, E. halophila. 68, E. uniglumis. 69, E. kamtschatica.

Sub-series: Truncatae (North American).

70, E. elliptica. 71, E. tenuis. 72, E. compressa. 73, E. nitida. 74, E. acutisquamata. 75, E. tricostata. 75a, E. cylindrica. 76, E. Bolanderi. 77, E. Palmeri. 78, E. decumbens. 79, E. Parishii. 80, E. intermedia. 81, E. Macounii.

Sub-series: Truncatae (chiefly South American).

82, E. Dombeyana. 83, E. crinalis. 84, E. Rabenii. 85, E. albibracteata. 86, E. montevidensis. 87, E. nodulosa. 88, E. Parodii. 89, E. elegans. 89a, E. densa. 90, E. Lechleri. 91, E. mendocina. 92, E. Spegazzinii. 93, E. Haumaniana.

Series 7. Tenuissimae.

94, E. minima. 95, E. urceolata. 96, E. Barrosii. 97, E. nana. 98, E. amazonica. 99, E. oligantha. 100, E. nigrescens. 101, E. subcancellata. 102, E. microcarpa. 103, E. retroflexa. 104, E. glauca. 105, E. alveolata. 106, E. Baldwinii. 107, E. vivipara. 108, E. subfoliata. 109, E. grisea. 110, E. minutissima. 111, E. tortilis. 112, E. tuberculosa. 113, E.

Chaetaria. 114, E. Brainii. 115, E. Schweinfurthiana. 116, E. caespitosissima. 117, E. anceps. 118, E. trilophus. 119, E. Naumanniana.

Series 8. SULCATAE.

120, E. nudipes. 121, E. pachystyla. 122, E. quinquangularis. 123, E. filiculmis. 124, E. glauco-virens. 125, E. Loefgreniana. 126, E. dunensis. 127, E. viridans. 128, E. pachycarpa.

Series 9. MULTICAULES. Old-world species, with 3-fid styles (except *E. carniolica*); usually with coarse culms. Spikelets frequently proliferous.

129, E. multicaulis. 130, E. marginulata. 131, E. limosa. 132, E. Baroni. 133, E. carniolica. 134, E. tetraquetra. 135, E. laeviseta. 136, E. pellucida. 137, E. congesta. 138, E. cylindrostachys. 139, E. acuta. 140, E. Dietrichiana. 141, E. Cunninghamii.

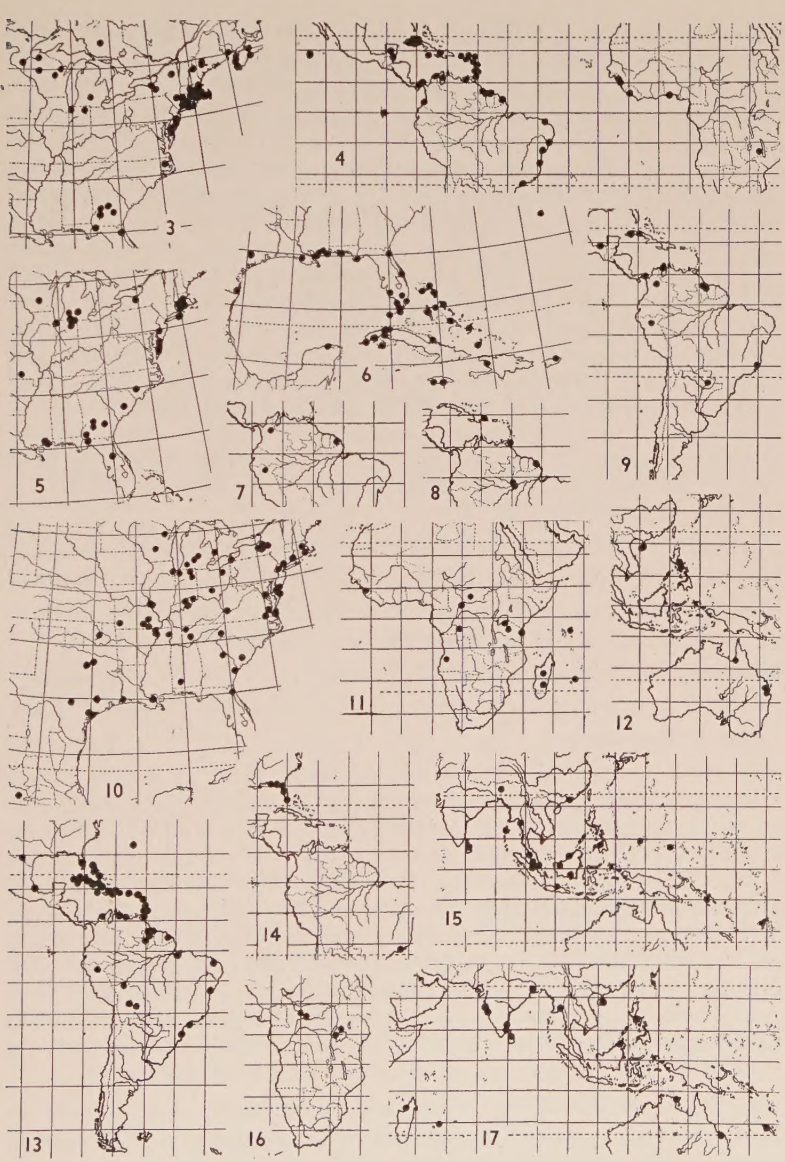
Species of uncertain classification.

142, E. minarum. 143, E. melanocarpa. 144, E. albida. 145, E. squamigera. 146, E. subarticulata.

Series 1: MUTATAE

1. E. FISTULOSA (Poir.) Link [MAP 28]; Svenson, RHODORA xxxi. 152 (1929); Brain, Proc. Rhodesia Sci. Assoc. xxxiii. 84, pl. x, fig. 7 (1934); Hutchinson & Dalziel, Fl. West Trop. Afr. ii. 468 (1936). *Scirpus fistulosus* Poir. (1804), not Forskål (1775).[1] *S. angulatus* Willd. ex Kunth, Enum. ii. 155 (1837) (in synonymy). *E. planiculmis* Steud. Syn. Cyp. 80 (1855). Additional citations: CUBA: Hatuey, Santa Clara, *León* no. 9215 (NY). MEXICO: (sine loc.) *F. Mueller* no. 1367 (NY). GUATEMALA: Puerto Barrios, Dept. Izabal, *Standley* no. 25150 (NY). PANAMA: Chiriqui, El Bouquete, 1200 m., *Killip* no. 4569 (NY); Chepo, prov. Panama, *Pittier* no. 4557. COLOMBIA: Popayan, Dept. El Cauca, *Pennell* & *Killip* no. 8241. ECUADOR: San Cristobal, Galapagos Ids., *Schimpff* no. 113 (NY) (scales purplish). BOLIVIA: Apolo, 4800 ft. *R. S. Williams* no. 916 (NY); Sara, Dept. Santa Cruz, *Steinbach* no. 7444 (NY). PARAGUAY: Villa Rica, *Joergensen* no. 4497 (NY) and *Morong* nos. 298 (NY), 499 (NY). ARGENTINA: Misiones, *Ekman* no. 1295 (NY); Tucuman, *Venturi* no. 8485 (US, B). BRAZIL: Bahia, *Salzmann*, hb. Lindley (TYPE of *Limnochloa obtusetrigona*); Caldas, Minas Geraes, *Regnell II* no. 1309 (S); S. José, Matto Grosso, *Lindman* no. A2663 (S); Porto Alegro, Rio Grande do Sul, *Malme* no. 446 (S). AFRICA: TANGANYIKA: Manyoni Dist., 4200 ft., *Burtt* no. 3673 (K) (var. *robusta*) (culms bright yellow-green; scales brown-margined; basal sheaths dark reddish-brown; bristles short, smooth); Bukoba, 3700 ft., *Haarer* no. 2078 (K); Nyakato, Bukoba Dist., *Haarer* no. 2121 (K). ANGLO-EGYPTIAN SUDAN: Meshra el Rak, *N. D. Simpson* no. 7650 (K). BELGIAN CONGO: Kabinda, 6° S. 24° E., *Becquaert* no. 62 (G). SENEGAMBIA: Casamanca, *Chevalier* no. 2432 (K); nw. coast, *Hendelot* no. 320 (K). SIERRA

[1] The earlier homonym does not prevent the name *Scirpus fistulosus* Poir. from being used in Eleocharis [cf. *E. intermedia* (Muhl.) R. & S. p. [56]].



Maps 3–17. Map of Eleocharis, 3, Robbinsii; 4, mutata; 5, equisetoides; 6, cellulosa; 7, Jelskiana; 8, mitrata; 9, plicarhachis; 10, quadrangulata; 11, variegata; 12, nuda; 13, interstincta; 14, elongata; 15, laxiflora; 16, calocarpa; 17, spiralis.

LEONE: Erimakuna, *Elliott* no. 4453 (K); Romietta, *Thomas* no. 5605 (K); sine loc., *Dighton* no. 339 (K); *Thomas* no. 5296 (K). CAMEROON: Buar, 6° N. 15° E., alt. 900–1000 m., *Mildbraed*, no. 9402 (K). RHODESIA: Salisbury, 4800 ft., *Eyles* no. 4742 (K) (culms light green; scales colored). MADAGASCAR: *Perrier de la Bâthie* no. 17929 (B) (scales more obtuse than usual; achenes as in Clarke's illustration); Ankazobé, *P. de la Bâthie* no. 2722 (B) (scales purple-tinged); *Parker* in 1880 (K), in part; *Petit-Thouars* (Berlin, *Willd.* no. 1196). INDO-CHINA: Annam, Mt. Bani, *J. & M. S. Clemens* no. 4050 (NY) (as *E. variegata*). JAPAN: cf. Tokio Bot. Mag. xviii. 110 (1904). JAVA: *Zollinger* no. 284 (Paris, TYPE of *E. planiculmis*); *Blume* (NY). PHILIPPINE ISLANDS: Manila, *Merrill* no. 9790 (NY); Tanculan, Mindanao, *Bur.-Science* no. 26116 (NY). BORNEO: *Beccari* no. 853 (K). INDIA: Peninsula Ind. Or., hb. *Wight* nos. 1902 (NY), 3154 (NY), and *Wallich Cat.* no. 3453B (NY); Upper Gangetic Plain, *Thomson* (NY). EAST BENGAL: *Griffith* no. 6235 (NY). BRITISH NEW GUINEA: Dagwa, Oriomo River, Western Division, *Brass* no. 6010 (NY). AUSTRALIA: Cairns, Cook District, *S. T. Blake* no. 9371 (B); Mouton Bay, *Mueller* (Br. Mus.).

Though the achene-body in oriental specimens averages 1.5 mm. long, as in American material, *Wight* no. 3154 (NY) has the achene-body 2.0 mm. long, with linear surface-markings resembling those of *E. laxiflora*, exactly as in Clarke's illustration (t. xxxv, fig. 4). In the enormous Bolivian specimens of *Steinbach* no. 7444 the achene-body is also 2 mm. long. In *Harris* no. 8513 (Jamaica) the bristles are perfectly smooth.

2. E. NUPEENSIS Hutchinson & Dalziel, Fl. West Trop. Afr. ii. 467 (1936). Similar to *E. fistulosa*. I believe the following are synonyms: *E. fistulosa* var. *robusta* Boeckl. Flora lxii. 563 (1876); Svenson, RHODORA xxxi. 153, pl. 188, fig. 13 (1929). *E. mitrata* var. *africana* C. B. Clarke in Thistleton-Dyer, Fl. Trop. Afr. viii. 406 (1902) and Durand & Schinz, Consp. Fl. Afr. v. 599 (1895) (nomen). *E. fistulosa* var. *micrantha* Chermezon, Archiv. Bot. Caen. vii. Mém. no. 4: 25 (1936).—The TYPE (*Barter* no. 1040 (K) from Nupe, northern Nigeria), has grayish achenes 2 mm. long, with brown-rimmed horizontal cells, and spikelets much more slender than in *E. fistulosa*. Judging from description, *E. fistulosa* var. *micrantha* (from Pont du Gendarme near Saint Louis, Senegal), is the same as *E. nupeensis*.

E. nupeensis, *E. fistulosa*, *E. mutata*, *E. variegata*, and *E. calocarpa* show great complexity in tropical Africa, and distinction between species is not yet wholly satisfactory.

3. E. QUADRANGULATA (Michx.) R. & S. [MAP 10]; Svenson, RHODORA xxxi. 132 (1929).—Noteworthy range extensions: NEW YORK: Panther Lake, Oswego Co., *House* no. 20112 (Alb); Long Pond, North Salem,

Westchester Co., *Dr. Meade* (Alb); Lake Mahtowantah, Fulton, Oswego Co., *Coville* no. 16 (Alb). West Virginia: Shawnee Lake, Mercer Co., *Core* in 1929 (W Va, Duke). North Carolina: Hendersonville, *Blomquist* no. 5572 (Duke). Georgia: Augusta, *Hildebrand* in 1923 (Duke). Indiana: Lake Everett, Allen Co., *Deam* no. 20819 (D); Fredonia, Crawford Co., *Deam* no. 27306 (D); Corydon, Harrison Co., *Deam* no. 20517 (D); Bass Lake, Starke Co., *Deam* no. 54251 (D, B); Adams Lake, Lagrange Co., *Deam* nos. 54104 (D, B), 55356 (D, B); Madison, Jefferson Co., *E. Banta* in 1934 (D, B). Louisiana: marsh near Orange, Texas, *Munz* no. 1456 (Pomona). Illinois: St. Clair Co., *Brendel* (Ill); Wolf Lake, *E. J. Hill* no. 90 (Ill); Mascoutah, *Welch* in 1862–1870 (Ill). Wisconsin: Crooked Lake, Oxford, Adams Co., *Fassett & Hotchkiss* no. 14396 (B); Shewano Lake, Shewano Co., *Hotchkiss & Koehler* no. 4311 (B). Mexico: Atequiza, Jalisco, *Pringle* no. 3473 (B) (scales strongly purple-margined).

Professor Fernald (Rhodora xxxvii. 393 (1935)) has distinguished the coarser plants characteristic of the northern range as var. *crassior*. Having collected the smaller variety in shallow ponds choked by other aquatic vegetation and the larger form in open deep ponds northward, I suspect that opportunity for growth with little competition is an important factor in determining size.

4. E. mutata (L.) R. & S. [map 4], Svenson, Rhodora xxxi. 133 (1929); Hutchinson & Dalziel, Fl. West Trop. Afr. ii. 467 (1936). Mexico: Lake Chichencanab, Quintana Roo, *Swallen* no. 2769 (US). Revillagigedo Ids.: Clarion I., *Howell* 8357 (Cal). British Honduras: Sibun R., *Gentle* nos. 1429, 1432 (Cath. Univ.). Ecuador: Puna Island, *Andersson* in 1852 (S, as *E. scariosa*). Brazil: Sebastianopolis, *Martius* no. 229 (NY); Ceará, *Drouet* no. 2503 (B); Rio de Janeiro, *Glaziou* no. 9337 (NY). Africa: Liberia: Monrovia, *Massey* no. 82 (NY). Sierra Leone: Mambolo, *Deighton* no. 978 (K); Bagroo River, *Mann* no. 93 (K); frequent in patches in tidal swamps, withstands considerable brackishness, *Glanville* no. 211 (K). Nigeria: salt water swamp, Lagos Island, *Barter* no. 2234 (K); Lagos, *MacGregor* no. 327 (K). British East Africa: Pemba, *Greenway* no. 2730 (K).

5. E. cellulosa Torr. [map 6]; Svenson, Rhodora xxxi. 152 (1929).

Occasional specimens with angled culms appear very close to *E. mutata*. A few specimens have bristles with traces of teeth; in *Britton, Britton & Brown* no. 6636 from Condado, Porto Rico, the bristles are strongly barbed. The glossy achene of *E. cellulosa* has much larger surface cells than the rough dull achene of *E. mutata*, and the scales are frequently reddish. With a single exception (*C. Wright*, Rutersville, Texas), all specimens are from brackish coastal areas.

6. E. VARIEGATA (Poir.) Presl [PL. 537, FIG. 4; MAP 11]. Culms stout (3 mm. wide), cylindric, often twisted, and sometimes trigonous below the inflorescence; spikelets lanceolate-cylindric, 1.5–2.5 cm. long, 3–4 mm. wide; scales *not appressed*, ovate, blunt, striate, convex, semi-glutinous, *yellow with ferruginous margins, the lacerate apex broadly hyaline;* stamens 3; style 3-fid (or 2-fid); achene obovate, biconvex, 2.0–2.5 mm. long, stramineous, with about 15 rows of inflated horizontally-elongated to isodiametric cells; style-base dark brown, flattened, 0.5 mm. long; bristles brown, equalling or exceeding the achene or frequently wanting.—Svenson, RHODORA xxxi. 156 (1929); Brain, Proc. Rhodesia Sci. Assoc. xxxiii. 84, pl. x, fig. 10 (1934); Chermezon, Arch. Bot. Caen iv, no. 7:40 (1931); Hutchinson & Dalziel, Fl. Trop. West Afr. ii. 84 (1936).—MADAGASCAR: massif de l'Andringitra, 2000 m., *Perrier de la Bâthie* no. 14567 (B); *Blackburn* (K); *Petit-Thouars* (Berlin, hb. Willd.). MAURITIUS: *Sieber* no. 19 (NY); *R. E. Vaughan* no. B2 (K). SEYCHELLES: Maké, *Thomasset* (K) (differs from *Sieber* no. 19 in heavier, longer bristles and closer reticulation of achene). BELGIAN CONGO: Wombali, *Vanderyst* nos. 4263, 4243 (K) (similar to Madagascar plant but lacks bristles). TANGANYIKA: Arusha, 4000 ft., *Haarer* no. 972 (K) (achene identical with *Sieber* no. 19; culms sharply 3-angled at apex); papyrus swamp, Kiagwe, Lake Victoria, 3700 ft., *Eggeling* no. 502 (K); Pemba, *Vaughan* no. 681 (K). ANGOLA: Benguella, country of the Ganguellas, *Grosweiler* no. 2767 (K) (culms shining; scales light brown to rose-color, with green center; no bristles). SIERRA LEONE: Mowoto, *Deighton* no. 1687 (K) (specimen young and questionable).

7. E. LAXIFLORA (Thwaites) H. Pfeiffer [PL. 537, FIG. 3; MAP 15], Mitt. Inst. Bot. Hamburg vii. 169 (1928). *E. variegata* var. *laxiflora* (Thwaites) C. B. Clarke; Svenson, RHODORA xxxi. 156 (1929). (?) *E. Graeffiana* Boeckl. Flora lviii. 108 (1875).—INDIA: Silhet, *Hooker & Thomson* (K); Tenasserim & Andamans, hb. *Helfer* no. 6220/1 (K); Malay Peninsula, *Griffith* no. 6229 (K); Singapore, *Hullett* in 1893 (K); *Ridley* no. 5799 (K); *Penang Botanic Gardens* no. 4543 (K); Malacca, *Lemann* in 1845 (K); Ceylon, hb. *Macrae* (K). JAVA: *Zollinger* nos. 266 (K), 291 (Paris, TYPE of *E. ochrostachys* Steud.). BORNEO: Banjarmasing, *Motley* no. 1266 (K); Sarawak, *Beccari* nos. 6 (K) & 3720 (K); *J. & S. Clemens* no. 20825 (NY); Kuching, *Ridley* no. 12347 (K). PHILIPPINE ISLANDS: Tanculan, Mindanao, *Bureau of Science* no. 26129 (NY). SUMATRA: Bila, *Toroes* no. 3027 (NY). FIJI ISLANDS: *Capt. Wilkes* (K) (as *E. Graeffeana*). CAROLINE ISLANDS: Ponape, *Kanehira* nos. 679 (NY), and 1515 (NY); *Ledermann* no. 13657 (K); Yap, *Kanehira* no. 1152 (NY). SOLOMON ISLANDS: chiefly New Georgia, *H. M. S. "Penguin,"* 1894–5 (K). The type of *E. Graeffeana* came from Opolu, Samoa.

8. E. NUDA C. B. Clarke [PL. 538, FIG. 4; MAP 12], Kew Bull. Add. Ser. viii. 21 (1908) and Ill. Cyp. t. xxxv. figs. 8–11 (1909). *E. philippinensis* Svenson, RHODORA xxxi. 155 (1929).—CHINA: Hainan, hb.

Canton Christian College no. 7793 (NY). AUSTRALIA: Buderim, Moreton Dist., Queensland, *S. T. Blake* no. 5227 (B); Cairns, Cook Dist., Queensland, *Blake* nos. 9360 (B) & 9361 (B); Virginia, Brisbane, *Blake* no. 1421 (B); between Norman and Gilbert River, *Gulliver* (K, TYPE).

In this species, as in most others of *Elcocharis*, presence or absence of bristles and direction of teeth are of little importance.

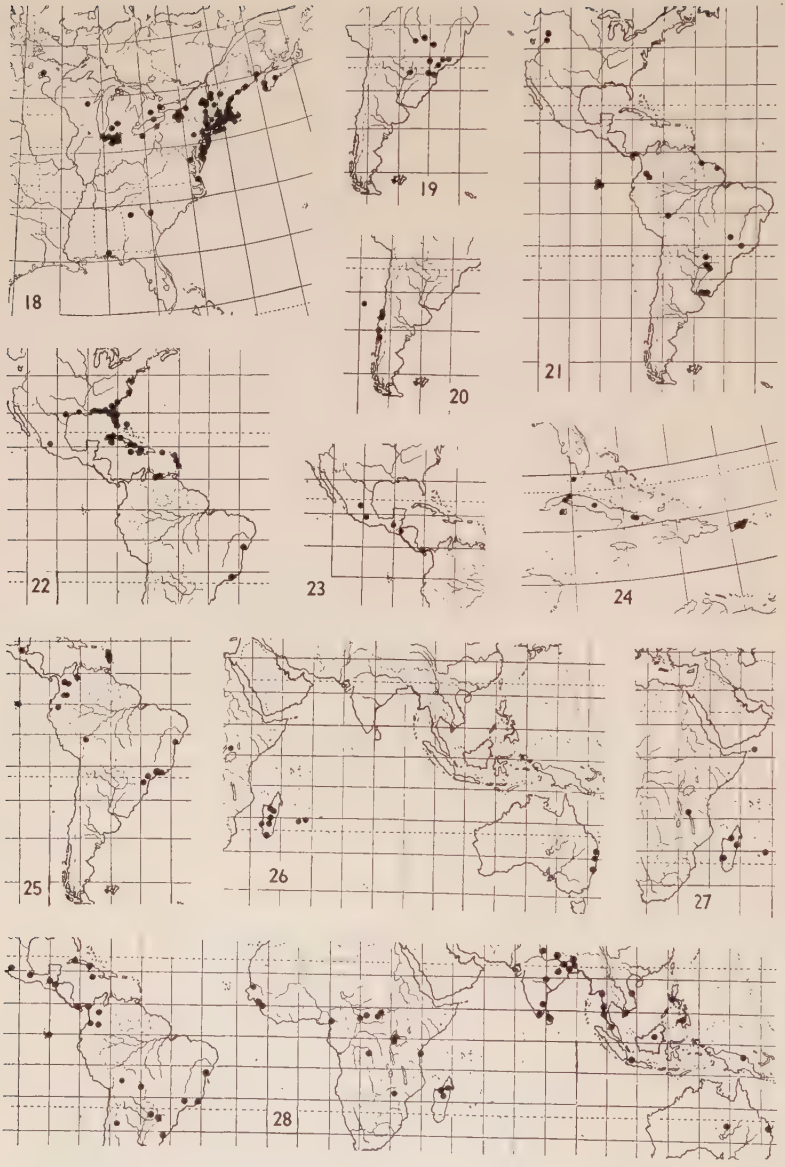
9. E. CALOCARPA Chermezon [PL. 537, FIG. 8; MAP 16]. Perennial, culms 3.5–7.5 dm. high, 2–2.5 mm. wide, rigid, quadrangular: spikelets cylindric, subacute, 20–35 cm. long, 3.5 mm. wide: scales lax, 4 mm. long, ovate-lanceolate, obtuse, stramineous-fuscous, sometimes with a reddish margin, striate, convex: stamens 3: style 3-fid: achene biconvex, obovoid, 2 mm. long, orange, with about 12 rows of horizontally-elongated, strongly inflated cells: style-base dark brown, conic, flattened, 0.5 mm. long; bristles light brown, surpassing the achene.—Arch. de Bot. Caen iv. no. 7: 41 (1931). AFRICA: Mangapou [6° N. 23° E.], Haut Oubangui, *Le Testu* no. 3162; King's Lake, Kampala, Uganda, 3900 ft., *Hancock & Chandler* no. 21 (K, B) (det. Chermezon).

var. NUDA Chermezon (l. c.). Differs from the type in lack of bristles, and smaller (1.5 mm. long), pale yellow achenes.—Moroubas, Haut Oubangui, *Tisserant* no. 1186; Masaka District, 3800 ft., Uganda, *Chandler* no. 1393 (K, B) (culms terete).

E. calocarpa and *E. variegata* appear to be very closely related. The achenes have the same type of inflated surface cells, approached nowhere else in the genus except in the Caribbean *E. cellulosa*. Except for color of achenes, the chief distinction seems to lie in the 4-angled culms of *E. calocarpa* as compared with the cylindric culms of *E. variegata*. Similar cylindric culms are characteristic of *E. cellulosa*, but sharply-angled culms are occasional. The absolute specific value of the angled culm is therefore open to question.

10. E. SPIRALIS (Rottb.) R. & S. [MAP 17]; Svenson, RHODORA xxxi. 135 (1929). *E. compacta* R. Br. Prod. 224 (1810). *Scirpus compactus* Poir. Encyc. Suppl. v. 102 (1817); Spreng. Syst. 1. 203 (1825). *E. austro-caledonica* Vieillard, Ann. Sci. Nat. Bot. ser. 4, xvi. 38 (1862).—Mauritius, Madagascar and the Orient. MAURITIUS: *Bouton* no. 3 (K). MADAGASCAR: marais saumâtres, baie de Bombetoka,[1] *Perrier de la Bâthie* no. 2498 (B). CHINA: in water near the sea, Hainan, *Liang* no. 66592 (NY). INDIA: East Bengal, *Griffith* no. 6231 (K); in subsalsis uliginosis insulae Salsette, *Jacquemont* no. 446 (K); Burma, *Griffith* (K); Bengal, *Lehmann* in 1845 (K); Bombay, *Lisboa* (?) (K); Tranquebar, *Rottler* in 1798 (K); Pondicherry, *Meebold* no.

[1] Professor Chermezon has informed me that this is the only station known in Madagascar and that the plant is perhaps an introduction.



Maps 18–28. Map of Eleocharis, 18, olivacea; 19, capillacea; 20, fusco-purpurea; 21, Sellowiana; 22, flavescens; 23, Schaffneri; 24, Sintenisii; 25, maculosa; 26, minuta; 27, intricata; 28, fistulosa.

2539 (K); CEYLON: *Thwaites* (K). PHILIPPINE IDS.: Manila, *Merrill* no. 9788 (NY). NEW CALEDONIA: *Pancher* (K); eaux sumâtres, *Vieillard* no. 1453 (K, COTYPE of *E. austro-caledonica*). AUSTRALIA: Arnhem, South Bay, *R. Brown* (K); north coast, *R. Brown* no. 5934 (Br. Mus., TYPE of *E. compacta*); Gladstone, Queensland, *S. T. Blake* no. 12790 (B). The species is also represented in the Willdenow Herbarium, no. 1195, fol. 1, *Roestal* (without locality).

11. E. INTERSTINCTA (Vahl) R. & S. [MAP 13]; Svenson, RHODORA xxxi. 130 (1929). *Limnochloa obsoleta* Nees in Martius, Fl. Bras. ii[1]. 100 (1842). *E. obsoleta* Steud. Syn. Cyp. 81 (1855). *E. cognata* Steud. Syn. Cyp. 81 (1855) [Guiana], e. desc. Additional noteworthy citations: FLORIDA: La Belle, Hendry Co., *F. M. Uhler* & *C. F. Smith* in 1937 (B). TEXAS: Neuces River, Uvalde Co., *E. J. Palmer* no. 14518 (B). BOLIVIA: 500 m., Buena Vista, Santa Cruz, *Steinbach* no. 5216 (G).

12. E. EQUISETOIDES (Ell.) Torr. [MAP 5]; Svenson, RHODORA xxxi. 131 (1929). Additional citations: NEW YORK: Mendon Pond, Monroe Co., *Mathews* in 1920 (Alb). DELAWARE: near Lewiston, *Nuttall* (NY). MICHIGAN: White Lake, Kalamazoo Co., *Hanes* no. 1377 (B); Sand Lake, Jackson Co., *J. Wright* (NY); Portage Lake, Jackson Co., hb. *S. H. Camp* no. 11434 (NY). INDIANA: Hunter Lake, Elkhart Co., *Deam* no. 52342 (B); North Twin Lake, Lagrange Co., *Deam* no. 52436 (B). WISCONSIN: Madison (coll. unknown) (G). MISSISSIPPI: Woolmarket, *Tracy* no. 3224 (NY); Ocean Springs, *Tracy* no. 91 (NY).

13. E. DULCIS (Burm. f.) Trinius [PL. 537, FIG. 6]; Svenson, RHODORA xxxi. 158 (1929). *E. equisetina* Presl; Svenson, RHODORA xxxi. 161 (1929). *E. plantaginoides* (Retz.) Domin, Bibl. Bot. xx. 445 (1915).

This widespread, cultivated oriental species, the Chinese water-chestnut, has appeared in West Africa (cf. Hutchinson & Dalziel, l. c., as *E. plantaginea*). Photographs of Presl's type of *E. equisetina*, which Dr. Malkovsky has most kindly sent me from the National Museum of Praha, show that it is a slender phase of *E. dulcis*. A specimen from the vicinity of Daru Island, British New Guinea, *Brass* no. 6064 (NY) has the robust character of *E. sphacelata*, associated with achenes typical of *E. dulcis*. Possibly it represents a transition between the two species.

14. E. SPHACELATA R. Br.; Svenson, RHODORA xxxi. 160 (1929).

15. E. ROBBINSII Oakes [MAP 3]; Svenson, RHODORA xxxi. 154 (1929).

Specimens possibly from the TYPE collection, labelled "White Mts. of N. Hampshire, cl. Oakes legit" are at the Brooklyn Botanic Garden, originating from the herbarium of C. F. Austin. The northernmost collection of *E. Robbinsii* seems to be W. R. Watson's no. 442 (Can) from the Timagami Forest Reserve, Ontario.

Mutatae: Key to the slender South American Species

Achenes trigonous; 1–1.5 mm. long (including style-base) ..... *E. elongata.*
Achenes biconvex; 2–4 mm. long (including style-base)
  Achene constricted into a neck below style-base
    Style-base trilobed ..... *E. mitrata.*
    Style-base not trilobed ..... *E. Jelskiana.*
  Achene not constricted ..... *E. plicarhachis.*

16. E. elongata Chapman [pl. 537, fig. 2; map 14]; Svenson, Rhodora xxxi. 155 (1929).—*E. elongata* has the smallest achenes in the group, the body being only 1.0–1.2 mm. long. Further citations: Florida: Appalachicola, *Chapman* (NY). Alabama: Point Clear, *Mohr* in 1866 (NY). Here belong also two specimens from Brazil: Rio de Janeiro, *Glaziou* nos. 9338 & 6430 (K), as *E. elata.*

On No. 9338 Clarke has commented "a startling plant to me. The nut nearly as that of *acicularis.*"

Also at Kew there is a collection from Sao Paulo (*Usteri* no. 24c) labeled as *E. elata.* It resembles *E. Robbinsii,* but has almost cylindric culms and spreading scales. The achene-body is 3 mm. long with about 20 rows of indistinct markings on each face (much as in *E. elongata*), constricted above as in *E. Sagotii,* with a dark brown style-base 1 mm. long, and bristles exceeding the achene. Judging from description, it is probably E. brasiliensis Boeckl. (cf. Svenson, Rhodora xxxi. 162 (1929)).

17. E. mitrata (Griseb.) C. B. Clarke [pl. 537, fig. 5; map 8]. *Scirpus mitratus* Grisebach, Fl. Br. W. I. 570 (1864).—Trinidad: Savana Tiareo, July 2, 1848, *Crueger* (cotype, K). San Domingo: Sabana de la Mar, Cordillera Central, *Ekman* no. 15611 (S). French Guiana: Cayenne, *Jelski* (Berlin, in part). Brazil: vic. Barra [Manaos], prov. Rio Negro, Dec.–Mar. 1850–51, *Spruce* (K); Campo de Jauauarí, Jan. 1851, *Spruce* no. 1289 (K).

E. mitrata, close to *E. plicarhachis* in appearance, has larger spikelets with obtuse thickened scales, and achenes 2.0 mm. long, including the blunt, usually tricuspidate, style-base which is 0.5 mm. long.

18. E. Jelskiana Boeckl. Linnaea xxxviii. 376 (1874) [map 7]. *E. Sagotii* C. B. Clarke, Kew Bull. Add. Ser. viii. 20 (1908); Uittien in Pulle, Fl. Surinam i. 111 (1934).—French Guiana: Cayenne, *Jelski* (Berlin, cotype of *E. Jelskiana*); Cayenne, *Sagot* no. 1390 (K, type of *E. Sagotii*). Colombia: Polonia, Santander, 100 m., *Killip & Smith* no. 14914 (NY). Peru: Tarapoto, *Spruce* no. 4284 (K, type of *E. Peruviana*[1]) and no. 4282 (K, NY).

The collection of *E. Jelskiana* at Berlin is mixed with *E. mitrata,* but from Boeckeler's description, the elements are separable. *E.*

[1] Kew Bull. Add. Ser. viii. 105 (1908) (nomen).

Jelskiana has cylindric slender culms (0.5–1.0 mm. wide), narrow spikelets not exceeding 2.5 mm. wide, and green appressed linear scales with darkened margins. The dull black achene (2 mm. long) has about 12 rows of poorly-defined hexagonal cells, the apex constricted below the conical style-base. The type of *E. Sagotii* is similar, except that the achenes are immature and yellowish.

19. E. PLICARHACHIS (Griseb.) Svenson [PL. 537, FIG. 1; MAP 9]; RHODORA xxxi. 158 (1929). *E. elata* Boeckl. *E. Sagotii* var. *glochidiata* C. B. Clarke, Kew Bull. Add. Ser. viii. 21 (1908).—CUBA: Pinar del Rio, *C. Wright* no. 3372 (NY); Mordazo, Santa Clara, *León & Cazanes* no. 5980 (NY). MEXICO: Tabasco, *Rovirosa* no. 438 (NY). PANAMA: Frijoles (Canal Zone), *Svenson* no. 433 (B). BRITISH GUIANA: *Jenman* no. 6111 (K (TYPE of *E. Sagotii* var. *glochidiata*), NY); Moruka River, Pomeroon Distr., *De La Cruz* no. 993 (NY); Wanama River, Northwest Distr., *De La Cruz* no. 4003 (NY). VENEZUELA: Maracaibo, *Merkel* (Cop, TYPE of *E. elata*). COLOMBIA: Puerto Berrio, Dept. Antioquia, *Pennell* nos. 3727 (NY); 3733 (NY). PERU: Yurimaguas, Dept. Loreto, alt. 125 m., *Killip & Smith* no. 27962 (NY, US). BRAZIL: Fazenda de Sta. Cruz, *Glaziou* 9338 (Paris, as *E. variegata*). PARAGUAY: Ipacaray, *Hassler* no. 12570 (G, K).

The type of *E. elata* consists of two very old sheets from Hornemann's herbarium, collected in Maracaibo. They show no indication of Brazilian origin.

Series 2: PAUCIFLORAE

[For nos. 20–24 see index to species, and RHODORA xxxvi. 377–389 (1934)].

25. E. MELANOMPHALA C. B. Clarke [PL. 539, FIG. 4]. Perennial with a lignescent base; culms inflated and spongy, 10–16 cm. long, 1 mm. wide; sheaths loose, stramineous, purplish at the base and at the obtuse oblique apex: spikelets ovoid, 5–6 mm. long, loosely 5–10-flowered: scales lustrous brown, obtuse to subacute, the lowermost with a broad greenish keel: stamens 3, anthers 1.5 mm. long: style 3-fid: achene broadly ovoid, 2.0 mm. high, 1.5 mm. wide, bluntly trigonous, stramineous, lustrous, with minute quadrangular-to-hexagonal reticulation: style-base small, black, short-pyramidal, not constricted at the base: bristles dark brown, half as long as the achene or rudimentary.—Engler, Bot. Jahrb. xxx. Beibl. 68: 24 (1901); Barros, Mus. Hist. Nat. Buenos Aires xxxiv. 468, fig. 21 (1928); Svenson, RHODORA xxxvi. 383 (1934).

The illustration from the COTYPE at the New York Botanical Garden has been added in order to round out the treatment of the

Pauciflorae. *E. melanomphala* represents the extreme of the *E. pauciflora* complex in South America, being characterized by unusual width of achene, and by the peculiar style-base. Since only a single collection is known, its articulation with *E. atacamensis*[1] is obscure.

Series 3: Aciculares

One way to treat this group is to place everything under *E. acicularis*, as many recent authors have done. No further discrimination is then required. Personally, I feel that the name *E. acicularis* should be restricted to slender plants of holarctic distribution, and that the plants of Mexico and the southern hemisphere (except for some obviously introduced examples in Australia) do not belong under *E. acicularis*. The dwarf alpine plants of the Andes and Mexico have been the greatest source of trouble, but after a considerable amount of boiling and dissecting, a fairly satisfactory conclusion has been reached, although I do not yet understand where *E. bonariensis* begins either in South America or in Mexico. The high Andean material (*E. exigua*), as Kunth observed in 1837, has two stamens instead of three (cf. pl. 539, fig. 9c) with anthers much reduced in size; the bristles when present are coarser than in *E. acicularis*. These characters hold well in the material which I have examined, to which may be added the fact that the Andean material has a totally different appearance than the European. *E. radicans* (*E. Lindheimeri*), *E. cancellata*, and *E. bella* also have consistently *two* stamens; other species of the *Aciculares* (perhaps excepting *E. brachycarpa* which I have not recently examined) have *three*. In the accompanying map of the *Aciculares* (map 1), the limits of distribution in Eurasia (*E. acicularis*) have been worked out from various floras. It is probable that *E. acicularis* does not occur throughout the interior of the Scandinavian peninsula. Also, despite reports, the group is probably absent through much of Patagonia. The link which I have shown connecting Colombia and Mexico is generalized, and represented by only one or two collections.

26. E. exigua (HBK) R. & S. [pl. 539, figs. 5, 9c]. Map 54. Dwarf plants with extensive filiform creeping rootstocks; culms 2–10 cm. high, capillary, frequently rigid and recurved, variously-angled: sheaths scarious, often dilated or emarginate at the apex: spikelets 2–3 mm. long. ovate to linear, *3–8 flowered:* scales obtuse or acute, *obri-*

[1] Treated by me under *E. pauciflora* (l. c.), of which it forms a fairly well-marked variety.

ously striate, green, sometimes with broad purple margins: *stamens 2; anthers 0.5 mm. long*, constricted at apex: achenes 1 mm. long, oblong-obovate, yellowish-green, obscurely trigonous with the intermediate longitudinal ribs frequently elevated, about 40-trabeculate in each longitudinal series: style-base usually acute: bristles 2, white, often absent.—Syst. ii. 154 (1817). *Scirpus exiguus* HBK. Nov. Gen. et Sp. i. 225 (1816). *E. costulata* sensu Svenson, Rhodora xxxi. 204, not Nees & Meyen. *E. rivularis* Phil. Linnaea xxxiii. 270 (1864–65); Boeck. Linnaea xxxvi. 427 (1869–70).—Colombia: in monte Quindiu [Central Cordillera, 5° N.] (Berlin, type of *Scirpus exiguus*); Bogota, *Lindig* no. 1425 (K); Bogota, "alt. 2650, Nov. 1855," *Triana* no. 430 (K, US). Ecuador: Mt. Chimborazo, 2680 m., *André* no. 4272 (K); Huigra, Prov. Chimborazo, 1200 m., A. S. *Hitchcock* no. 20352 (NY) and *Rose* no. 22415 (NY); Quito, *Jameson* (K) and *Spruce* no. 5206 (K); Riobamba, *Mille* no. 338 (NY). Bolivia: Comarapa, Dept. Cochabamba, *Steinbach* no. 8521 (NY). Chile: *Cuming* (K); Valparaiso, *Jaffuel* no. 759 (G); Conception, *Jaffuel* no. 2955 (G).

The type of *Scirpus exiguus* (hb. *Willdenow* no. 1168) is a poor and sprawling specimen with flaccid culms, 5–6-flowered spikelets (3 mm. long) with divergent purplish-banded scales, and rather broad achenes with short conical style-base. Jaffuel's specimens from Chile, with black spikelets and two stamens with anthers 0.5–0.7 mm. long, conform to the description of *E. rivularis*. Philippi's type of *E. rivularis* came from the Aconagua River near S. Rafael.

27. E. radicans (Poir.) Kunth, Enum. ii. 142 (1837) [pl. 539, fig. 9a; map 61]. *Scirpus radicans* Poir. Encyc. vi. 751 (1804). *Eleogiton radicans* A. Dietrich, Sp. Pl. ii. 97 (1833). *Eleocharis costulata* Nees & Meyen ex Kunth, Enum. ii. 142 (1837); (?) Desvaux in C. Gay, Fl. Chil. vi. 172 (1853), not Svenson, Rhodora xxxi. 204 (1929). *Chaetocyperus costulatus* Nees & Meyen (1842); (Rhodora, l. c.). *E. Lindheimeri* (Clarke) Svenson, Rhodora xxxi. 199 (1929).—Porto Rico: *Ledru* (type not seen). Haiti: Furcy, 1300 m., *Leonard* no. 4812 (NY). Santo Domingo: Cordillera Central (2500 m.), *Ekman* nos. 14130 (S) & 13650 (S); Sierra de Ocoa, *Ekman* no. 11936 (S); Santiago, *Ekman* no. 16534 (S). Peru: *Dombey* in 1829 (Berlin). Chile: Cordillera de St. Fernando, *Meyen* in 1831 (type of *Ch. costulatus*), dwarf plants 3 cm. high (Berlin); Valdivia, *Philippi* (K); Valparaiso, *A. Pirion* no. 757 (in part) (G). Argentina: Sierra Achala, Cordoba, *Hieronymus* no. 642 (Berlin, K) (a large form with culms to 10 cm.; no bristles); Tucuman, *Hieronymus* & *Lorentz* no. 1074 (Berlin); Catamarca, *H. & L.* nos. 434, 474 (Berlin); Tucuman, Dept. Alta Cruz, *Venturi* no. 2283 (US, B) & Dept. Leales, *Venturi* no. 597 (US, B); Jujuy, Dept. San Pedro, *Venturi* no. 9643 (NY); Posados, Misiones, *Ekman* no. 1244 (NY). Uruguay: Dept. Canelones, *Osten* no. 21635 (B); Montevideo, in paludosis dunarum, *Osten* no.

22515 (B) (dwarf rigid form, issued as *E. acicularis* var. *lilliputiana*); Bañados, *Lorentz* no. 453 (K, as *E. retroflexa*).

E. radicans is the only member of the *Aciculares* known from the West Indies, and there only in Porto Rico and Haiti. In North America it is sporadic (see Professor Fernald's map in Rhodora xxxix. 483 (1937)); but in Argentina apparently not uncommon, though until recently I had seen no specimens. The stamens are 0.3–0.5 mm. long and sometimes mucronate as in Desvaux's illustration, which is perhaps correctly referred to *C. radicans* by Clarke (Engler, Bot. Jahrb. xxx. Beibl. 68: 22 (1901)). The bristles are often short or entirely lacking.

28. E. bonariensis Nees in Hook. Journ. Bot. ii. 398 (1840) [map 59]; Svenson, Rhodora xxxi. 202 (1929). *Chaetocyperus bonariensis* Nees in Martius, Fl. Bras. ii[1]. 96 (1842). *C. obtusatus* Nees (l. c.) p. 94; Steud. Syn. Cyp. 73 (1855). *E. acicylariformis* Greenman, Proc. Am. Acad. xxxiv. 566 (1899); Svenson, Rhodora xxxi. 202 (1929). *E. acicularis* subsp. *bonariensis* Osten, Anales Mus. Hist. Nat. Montevideo, ser. 2a, iii. 173 (1936).

The European *E. acicularis* (cf. pl. 539, fig. 1) has, in general, dwarfed capillary culms, fragile, non-costulate elongate achenes, 1 mm. long, with a small acicular style-base. The type of *E. bonariensis* (hb. Lindley, Cambridge) is a small plant with rather coarse rhizome and purplish scales, but the species varies greatly in size. Tweedie's plant at Kew has filiform culms up to 37 cm. long, and somewhat distichous spikelets with blunt, yellowish-green, slightly erose scales, and with a firm incurved sheath-apex, resembling a quill pen. *E. squamata* Boeckl. Cyp. Nov. ii. 11 (1890) was based on young material (hb. Berlin) collected in Minas Geraes by Schenck. The numerous culms are only 6 cm. high, sheaths somewhat inflated but not mucronate, and scales much as in typical *E. tenuis*. It is possibly a juvenile collection of what I have called *E. squamigera*, but does not belong with *E. bonariensis* (cf. Barros, op. cit. p. 450). The type collection of *Ch. obtusatus* (Berlin, hb. *Nees* no. 1722) is an immature, dwarf (7 cm. high) specimen of *E. bonariensis*, with fan-shaped obtuse lower scales.

E. striatula Desv. has been included by Clarke under *E. bonariensis* (Engler, Bot. Jahrb. xxx. Beibl. 68: 22 (1901)) and this treatment is substantiated by Gay's illustration and Desvaux's specimens at Paris and at Kew. The spikelets are approximately 15-flowered, with brown-rimmed, obtuse scales; the achenes measure slightly over 1.0 mm. long, with blunt enlarged tubercles. In large Mexican specimens of the *Aciculares*, the scarious character of sheaths is inconstant.

E. acicularifórmis should be treated as a synonym of E. BONARIENSIS, with the additional MEXICAN citations: Durango, *E. Palmer* no. 386 in 1896 (NY); Valle de Mexico, *Schaffner* no. 21 (NY) (as *E. striatula*). Additional citations for *E. bonariensis:* BRAZIL: Rio Grande do Sul, *Schwarzer* in 1899 (S). ARGENTINA: Cordoba, *Kurtz* no. 6635 (NY) and *O. Kuntze* no. 36 (NY); also *Stuckert* nos. 241 (K), 7614 (K); La Cumbre, 1200 m., *Barros* no. 1743 (B); Chicligasta, Tucuman, *Lillo* nos. 15542 (B), 15538 (B); Buenos Aires, *Barros* nos. 124 (B), 226 (B); Palermo, Capital Federal, *Barros* nos. 58 (B), 631 (B), 640 (B); Salta, *O. Kuntze* no. 35 (NY). URUGUAY: Canelones, *Osten* no. 20070 (B); Maldonado, locis humidis in dunis, *Osten* no. 22686 (B); Carrasco, Montevideo, *Osten* no. 22304 (B); San José, *Osten* no. 22715 (B). PARAGUAY: Rica, *Joergensen* no. 3581 (US, B); Asuncion, *Morong* no. 87 (NY). CHILE: Rancagua, *Bertero* no. 613 (NY); Talcahuano, Conception, *Skottsberg* no. 1167 (NY).

29. E. STENOCARPA Svenson [MAP 56], RHODORA xxxi. 205 (1929).—Additional citations: VENEZUELA: San Rafael, Mérida, *Pittier* nos. 12895 (NY) & 13218 (NY). COLOMBIA: Paramo de Romeral, Santander, 3800–4100 m., *Killip & Smith* no. 18520 (NY).

30. E. NERVATA Svenson [MAP 60], RHODORA xxxi. 204 (1929). *Chaetocyperus radicans* Steud. Syn. Cyp. 74 (1855). *Heleocharis radicans* (Steud.) Hemsley, Biol. Cent.-Am. Bot. iii. 456 (1885), not R. & S. *H. acicularis* Hemsley, (op. cit.) iii. 454 (1885) (partim). Previous citations from Ecuador should be excluded and the following added: MEXICO: Oaxaca, 8–9000 ft., *Galeotti* no. 5748 (K, COTYPE of *Ch. radicans*); in summo Monte San Felipe, ubi glacier apotheca, Oaxaca, *Andrieux* no. 49 (K) (NY?); Eugenio, Orizaba, *F. Mueller* no. 1973 (Sept. 1853) (NY); *Mueller* (sine loc.) no. 1975 (NY). GUATEMALA: Santa Elena, Chimaltenango, 2400–2700 m., *Skutch* no. 429 (NY, US). Boeckeler's specimen of *E. triflora* at Berlin is *E. nervata;* the TYPE at Copenhagen is *E. parvula* var. *anachaeta.*

The small alpine Mexican plants passing as *E. acicularis* have three stamens with anthers rather consistently 0.7 mm. long. Very likely a transition occurs between the smaller plants of *E. acicularifórmis* and the type of *E. nervata* (similar to Skutch's collection), thence to dwarf, capillary material such as the type of *Chaetocyperus radicans,* with achenes often only 1.0 mm. long. *C. radicans* was described quite independently of *Eleocharis radicans* (HBK) R. & S.

31. E. BRACHYCARPA Svenson, RHODORA xxxi. 200 (1929).

32. E. CANCELLATA S. Wats.; Svenson, RHODORA xxxi. 200 (1929).

It is not certain that the Mexican Boundary Survey actually collected this species in New Mexico, since they also visited Sonora, from which there is a collection June, 1851, *Thurber* (NY).

33. E. BELLA (Piper) Svenson [MAP 53], RHODORA xxxi. 201 (1929).

Additional citations: Washington: Klickitat Co., *Suksdorf* no. 588 (NY). Oregon: Crow Creek, Wallowa Co., alt. 4425 ft., *E. P. Sheldon* no. 8506 (NY). Nevada: Truckee River bottom, Glendale, *Hillman* in 1894 (NY). California: Moulton, Warner Mts. [Modoc Co.], *Griffiths & Hunter* no. 478 (NY); near Calaveras Big Trees, *Dudley* in 1906 (NY); Mt. Shasta, *H. E. Brown* no. 543 (NY); Jonesville, Butte Co., *Copeland* no. 344a (NY). Montana: Lola Hot Springs, *J. E. Kirkwood* no. 1548 (hb. Oberlin Coll.), a noteworthy range extension.

34. E. Reverchonii Svenson [map 57], Rhodora xxxi. 203 (1929). —Additional citations: Texas: San Diego, *Nealley* in 1893 (NY); "Hogbed prairie," *C. Wright* no. 512 (NY); prairie near Indianola [Port Lavaca], *Ravenel* no. 96, May 3, 1869 (NY); San Antonio, *C. R. Ball* no. 947 (NY); Valley of the Lower Rio Grande, *Buckley* (NY).

Examination of better material shows that mature achenes average 0.7 mm. long and the three stamens have anthers 0.7–1.0 mm. long. The style-base is blunt and rounded. Nealley's collection is perhaps most representative of the species, having a long rhizome with isolated tufts of culms which are 2–6 cm. high; therefore much shorter than the elongated form originally described.

35. E. Wolfii A. Gray [map 58]; Svenson, Rhodora xxxi. 201 (1929).—Added citations: New York: Train's meadow swamp, Woodford, Long Island, *Ferguson* in 1927 (NY) (station now destroyed). Tennessee: French Broad River, *Buckley* (NY). Louisiana: Jackson, East Feliciana, *Carpenter* in 1837 (NY) (cited as *E. compressa*). Colorado: Black Forest, El Paso Co., *J. H. Christ* no. 1029 (Cornell). Assiniboia: Crane Lake, *Macoun* no. 7548 (NY).

36. E. acicularis (L.) R. & S. [pl. 539, figs. 1, 9b; map 55]; Svenson, Rhodora xxxi. 184 (1929). (?) *Scirpus yokoscensis* Fr. & Savat. Enum. Pl. Jap. ii. 543 (1879). *E. comosa* C. Richt. Pl. Europ. i. 143 (1890).—Additional citations (showing limits of known range in America): Greenland: 68°–72° N., cf. Porsild, Meddel. Groenl. Bd. 93, no. 3: 33 (1935). Labrador: Nascaupee River, Hamilton Inlet, cf. Wetmore, Rhodora xxv. 5 (1923). Ontario: James Bay, *Macoun* in 1904 (NY); Moose Factory, James Bay, *Spreadborough* no. 62669 (Can); Timagami Forest Reserve, *W. R. Watson* nos. 370 (Can), 455 (Can). Manitoba: Rapid City, *Macoun* no. 16359 (Can). Alberta: Forestburg, *E. H. Moss* no. 1452 (Kew); Crows Nest Pass, Rocky Mts., *Macoun* no. 23174 (Can). Saskatchewan: Cumberland House, *Richardson* (NY). Oklahoma: Coal Creek Camp [Le Flore Co.], *Bigelow* in 1853 (NY). Alaska: Fairbanks, *J. P. Anderson* no. 1495 (NY); Bonanza Creek, Yukon, *Macoun* in 1902 (NY). Florida: Lake Jackson [Tallahassee Co.], *Spury* no. 544 (US). North Carolina: Raleigh, *Blomquist* no. 5556 (Duke); Yadkin River, Davidson County, *Blomquist* no. 5557 (Duke). Georgia: Princeton,

ELEOCHARIS (habit × ½, spikelets × 2, achenes × 10). FIG. 1, E. PALLENS. FIG. 2, E. ACUTA. FIG. 3, E. PLANA. FIG. 4, E. NUDA. FIG. 5, E. DIETRICHIANA. FIG. 6, E. BRASSII.

Eleocharis (habit × ½, spikelets × 2½, achenes × 20). Fig. 1, E. acicularis. Fig. 2, E. pusilla. Fig. 3, E. acicularis var. occidentalis. Fig. 4, E. melanomphala. Fig. 5, E. exigua. Fig. 6, E. limosa. Fig. 7, E. acicularis var. gracilescens. Fig. 8, E. Baroni. Fig. 9, Flowering stage of: a) E. radicans, b) E. acicularis, c) E. exigua.

Clarke Co., *Harper* in 1897 (B). KENTUCKY: Hodgenville, *Svenson* no. 4410 (B).

E. ACICULARIS var. GRACILESCENS Svenson, RHODORA xxxi. 191 (1929) [PL. 539, FIG. 7]. *Isolepis longifolia* Steud. Syn. Cyp. 90 (1855).

The TYPE of *I. longifolia* (Paris) is a specimen collected at St. Louis by *Kampmann* [?] (hb. *Riehl* no. 349). As seen in middle Tennessee, where it occupies shallow ponds in competition with *E. quadrangulata*, the variety is strikingly different from the ubiquitous *E. acicularis* of the northern states.—TENNESSEE: Pelham, Grundy Co., *Svenson* 7608 (B); McMinnville, Warren Co., *Svenson* no. 7038 (B). About the California citations of var. *gracilescens* I am not so confident. Further collecting will probably show that they are elongated forms of var. *occidentalis*.

37. E. PUSILLA R. Br. Prod. 225 (1810) [PL. 539, FIG. 2]; Benth. & Mueller, Fl. Austral. vii. 297 (1878). *Scirpus pumilio* Spreng. Syst. i. 204 (1825).

The TYPE (*R. Brown* no. 5931), in the British Museum of Natural History, is a very young specimen of the *Aciculares*, with hardened semi-bulbous culm-bases, and with the rhizome lacking. The spikelets are 4 mm. long, scales deep brown, anthers 1.5 mm. long. The illustration is from *S. T. Blake*, no. 4943 (B) collected in grassland, Gatton Agricultural College, southeast Queensland.

(*To be continued*)

SOME ALGAL COMPLEXITIES[1]

V. J. CHAPMAN[2]

A. RHIZOCLONIUM TORTUOSUM (DILLW.) KÜTZ. AND CHAETOMORPHA TORTUOSA KÜTZ.

DILLWYN in his British Confervae (1805) described a filamentous green alga which he named *Conferva tortuosa*. In 1845 and 1849 Kützing described two plants, one founded on Dillwyn's *Conferva tortuosa* and the other on *C. tortuosa* J. Ag. *non* Dill. One of these plants—with filaments 32–35 μ dia.—he referred to *Rhizoclonium* (1845). The other plant was placed in the genus *Chaetomorpha* (1849) and the filaments were described as being 46–56 μ.

[1] The American material was collected during the author's tenure of a Henry Fellowship at Harvard in 1935–36.

[2] Drosier Research Fellow of Gonville and Caius College, Cambridge, England.

Apart from the somewhat regrettable founding of two species with the same specific name in two very closely allied genera Kützing distinguished clearly and adequately that there were two distinct plants. Later authors, however, have often confused the two completely, some recognising only *Rhizoclonium tortuosum* and including in it the large forms, and others recognising only *Chaetomorpha tortuosa* and including in it the narrow forms.

There is no great difficulty in distinguishing between the extremes of the genera *Rhizoclonium* and *Chaetomorpha*. *Rhizoclonium riparium* with its rhizoidal branches is a completely distinct species from such as *Chaetomorpha aerea* or *Chaetomorpha linum*. Both genera, however, possess species which are excessively difficult to demarcate. In particular, there are *Rhizoclonium tortuosum* and *Rhizoclonium implexum*, both without any rhizoidal branches and with the same loose-lying habit. *Chaetomorpha tortuosa* also occurs in loose-lying masses, unbranched, and with cells whose diameter is only very slightly more than that of either *Rhizoclonium tortuosum* or *R. implexum*. Hence the great confusion in the literature. It may be doubted, indeed, whether there is any real justification for the genus *Chaetomorpha*. It could be argued that the three almost cosmopolitan species cited above are relics of a common parent stock, and that subsequently this group has evolved along two separate paths, one leading to the extreme *Chaetomorpha* type, the other to the extreme *Rhizoclonium* type. If it were not for the existence of these "übergang" species the two genera could be completely separated, but as these 'bridge' forms exist it may seem preferable in the future to regard all these species—both *Rhizoclonium* and *Chaetomorpha*—as belonging to one genus. A cytological investigation might be expected to throw some light on this problem.

An attempt has been made by the present author to unravel the tangle of synonymy surrounding *Rhizoclonium tortuosum* and *Chaetomorpha tortuosa*, and whenever possible authentic specimens of the early authors have been re-examined.[1]

Rhizoclonium tortuosum (Dillw.) Kütz. *Conferva tortuosa* Dillw. Brit. Conf. Fasc. 7. London 1805; C. Ag. Syst. Alg. p. 98. Lund 1824. *Conferva implexa* Harv. Phyc. Brit. Tab. 54B. 1846. *Rhizoclonium tortuosum* Kütz. Phyc. Germ. p. 205. Nordhausen 1845; Spec. Alg. p.

[1] I am grateful to Professor H. H. Dixon of Trinity College, Dublin, and Mr. Tandy of the British Museum for facilities in this connection, and to the latter, in addition, for helpful criticism in technical details.

384. Leipzig 1849; Tab. Phyc. Vol. 3. T. 68. i. 1853; Le Jol. Alg. Mar. Cher. p. 58. Paris 1880; Hauck, Meeresalg. in Rabenhorst's Krypt. Flora. p. 443. Leipzig 1885; De Toni, Syll. Alg. Vol. 1 p. 280. Patavii 1889. *Rhizoclonium hieroglyphicum* var *tortuosum* Stockm., Über die Algengattung *Rhizoclonium*. Verh. K. K. Zool. Bot. Gesell. in Wien. Vol. 40, p. 583. 1890; West, Alg. Vol. 1 p. 268. Cambridge 1916.

Exsiccatae: *Conferva implexa* Wyatt. Alg. Dan. No. 142. *Rhizoclonium riparium* var. *validum* Nord et Witt. No. 624. *Rhizoclonium rigidum* Nord et Witt. No. 626 *pro parte*.

It is probable that *Rhizoclonium tortuosum* Kütz. in Phyc. Germ. includes *R. implexum* because in the two subsequent works Kützing separated off the latter as a new species.

One difficulty about this species is that most American Phycologists have regarded *Rhizoclonium tortuosum* as being synonymous with *Chaetomorpha tortuosa* (Farlow 1881; Collins 1909; Setchell and Gardner 1920; Taylor 1937). According to Dillwyn (1805) the type specimen is in Dillwyn's seventh fascicle, but a search in the Linnean Society's rooms only produced the first four fascicles. However, there is an authentic Dillwyn specimen in the British Museum and this was examined. The cells ranged from 34–48 μ wide with an average width of 40 μ. Therefore so far as diameter is concerned, it would appear to be intermediate between the usually accepted dimensions of *Rhizoclonium tortuosum* and *Chaetomorpha tortuosa*. The cells were 1–2 times as long as broad, the chloroplasts were light green, and I think the plant may properly be regarded as *Rhizoclonium tortuosum* in the sense of Kützing. The chloroplasts of *Chaetomorpha tortuosa*, on the other hand, are usually dark green in colour. Dillwyn rather surprisingly remarks that his plant is closely allied to *Conferva capillaris* (*Chaetomorpha linum*) but this is hardly the case.

The usually accepted dimensions of *Rhizoclonium tortuosum* are 32–35 μ. From specimens which have been examined it would appear that the range is much greater, 30–48 μ and the average length of the cells is about 1½ times as long as broad. Hauck (1885) gives the diameter as 25–40 μ but he probably included in this assemblage *Rhizoclonium implexum* whose threads are narrower than *Rhizoclonium tortuosum*. Stockmayer (1890) gives the diameter as 26–40 μ but he certainly included *Rhizoclonium implexum* because he cites it as one of the synonyms. He further regarded his *Rhizoclonium tortuosum* as being synonymous with *Conferva tortuosa* Harv. but not with *C. tortuosa* Dillw., and also synonymous with *Rhizoclonium tortuosum* of

Farlow, whereas both these should properly be referred to *Chaetomorpha tortuosa*. He is, however, correct in giving the *Rhizoclonium tortuosum* of Hauck (1885) and Le Jolis (1863) as synonymous. Both Stockmayer and De Toni confused the issue by wrongly ascribing *Chaetomorpha tortuosa* Kütz. to *Conferva tortuosa* Dillw. Stockmayer adopted the name *Rhizoclonium hieroglyphicum* Kütz. for a group of existing species (*Rhizoclonium riparium*, *R. implexum* and *R. tortuosum* and considered each to be a variety of this one species. This is probably his most valuable contribution to the study of the genus.

The *Rhizoclonium tortuosum* described by Collins (1909), Farlow (1881), Harvey (1846), Setchell and Gardner (1920), and Taylor (1937) is to be taken as *Chaetomorpha tortuosa*.

Authentic specimens of *Conferva tortuosa* and *Conferva implexa* from Harvey's collection have been examined. The specimens of *Conferva tortuosa* all belong without doubt to the genus *Chaetomorpha*.

Setchell and Gardner were correct in making the above assumption but hardly correct in assuming *Conferva tortuosa* Harv. to be synonymous with Dillwyn's *Conferva tortuosa*. It is to be noted that the cells are by no means barrel-shaped as they should be for a true *Chaetomorpha*—and they are not even drawn so in Harvey's Plate (54A). The cell diameters ranged from 40–80 μ.

Harvey's *Conferva implexa* is a little more puzzling. His description is clearly that of *Rhizoclonium tortuosum* but the plate (54B) shows the barrel-shaped cells of a *Chaetomorpha* and one specimen—from Malahide, Co. Dublin—undoubtedly is *Chaetomorpha tortuosa* (cells 60–68 μ dia.), although in his description he gives the diameter of the species as two thirds that of *Chaetomorpha tortuosa* (e.g. two thirds of 60 μ = 40 μ). The other specimens of Harvey under *C. implexa* were referable to *R. tortuosum*. It may be suggested that Harvey was perhaps not quite clear about these two species, but he did realise that there were two and he described them correctly even though one of his specimens was misnamed. *Conferva implexa* Harv. from his description and other specimens must be taken as synonymous with *Rhizoclonium tortuosum* (Dillw.) Kütz. Many of Harvey's synonyms for *Conferva implexa* probably refer to forms which are now regarded as *Rhizoclonium implexum*.

Rhizoclonium tortuosum in Rabenhorst (1885) is correctly so named by Hauck but the synonyms are doubtful because they are copied from Harvey. The reference to Harvey's plate (54A) is misleading,

since, as shewn above, this depicts *Chaetomorpha tortuosa*. The diameter of the threads is given as 26–40 μ and this must signify the inclusion of *Rhizoclonium implexum*. I have examined a specimen of *Conferva implexa* from Wyatt's Alg. Dan. and it is undoubtedly *Rhizoclonium tortuosum* with threads 35–45 μ dia. A plant labelled *Chaetomorpha tortuosa* (from Jersey) in Herb. J. Gay is also *Rhizoclonium tortuosum* (threads 32–40 μ diam.). The walls only exhibited thickening at the septa and this appears to be characteristic of the species. When *Rhizoclonium riparium* var. *validum* Nord. et Witt. no. 624 was examined the threads were found to be 28–40 μ wide, average width 32 μ which places the specimen as *Rhizoclonium tortuosum*. *R. rigidum* Nord. et Witt. No. 626 appears to be a mixture of two plants in one of which the threads are 32–40 μ and hence this part of the specimen must be regarded as *R. tortuosum*.

Chaetomorpha capillaris (Kütz.) Börg. [*Conferva tortuosa* J. Ag. Alg. Med. et Adr. p. 12. Paris 1842. *non* Dillw.; Harv. Phyc. Brit. T. 54A. 1846; Harv. Ner. Bor. Amer. Part III. Smithson. Contr. Knowl. Vol. xi. p. 88. T. 46 B. 1858]. *Rhizoclonium capillare* Kütz. Diagnosen und Bemerkungen zu Neuen oder Kritischen Algen. *Bot. Zeit.* vol. 5. p. 166. 1847. [*Chaetomorpha tortuosa* Kütz. Spec. Alg. p. 376. Leipzig 1849; Tab. Phyc. Vol. 3. T. 51.2. 1853; Hauck, Meeresalg. in Rabenh. Krypt. Flora. p. 439. Leipzig 1885; De Toni, Syll. Alg. Vol. 1 p. 266. Patavii 1889; Foslie, M. Contrib. to Knowl. Mar. Alg. Norw. p. 142. Trömsö 1890; Newton, L. Handb. Brit. Seaw. p. 91. 1931]. *Chaetomorpha Callithrix* Kütz. Spec. Alg. p. 376. Leipzig 1849; Tab. Phyc. Vol. 3. T. 51. 1. 1853. *Chaetomorpha mediterranea* Kütz. Spec. Alg. p. 381. Leipzig 1849. *Spongopsis mediterranea* Kütz. Phyc. Gen. p. 261. Leipzig 1843; Tab. Phyc. Vol. 3. T. 50. 1853. *Rhizoclonium tortuosum* sensu Farlow, Mar. Alg. New Engl. p. 49. Washing. 1881; Collins, F. S. Green Alg. N. Amer. Tufts Coll. Stud. Vol. 2. p. 328. 1909; Setch. and Gard. Mar. Alg. Pac. N. Amer. Part II. Chlorophyceae. Univ. Calif. Pub. Bot. vol. 8. p. 185. 1920; Taylor, W. R. Mar. Alg. N. E. Coast of America. Univ. Mich. Press. p. 83. 1937. *Chaetomorpha capillaris* (Kütz.) Börg. Mar. Alg. Canar. K. Danske. Vidensk. Selsk. Biol. Meddel. p. 45 vol. V. 1925.

Kützing in his description of *Chaetomorpha tortuosa* (1849) refers *only* to J. Ag. Alg. Med. et Adr. p. 12. 1842. In this latter work J. Agardh refers his plant to *Conferva tortuosa* in Ag. Syst. Alg. p. 98., which in its turn is referred to *C. tortuosa* Dillw. (1805). Kützing however is careful to give only the reference to J. Ag. (1842) and he obviously considered that J. Agardh and C. Agardh were describing two different plants under the same name.

Both Foslie (1890) and De Toni (1889) wrongly ascribed *Chaetomorpha tortuosa* to *Conferva tortuosa* Dill.

Chaetomorpha capillaris as understood by most authors includes plants of diameter 40–100 μ, the average being 60–70 μ. Kützing in the original description gave the diameter of the filaments as 46–56 μ. The filaments are rigid, slender, much curled and twisted, the cells being one to three times as long as broad. The chloroplast is a bright dark green. The species has thicker, more lamellate walls than *Rhizoclonium tortuosum*. Farlow's (1869) description and synonyms apply to *Chaetomorpha tortuosa* with one exception; he remarks that branches are few and short, but this is probably the form later described by Holden as *f. polyrhizum*. Farlow incorrectly describes his plant as synonymous with *Conferva implexa* Harv. but is correct in making it synonymous with *C. tortuosa* Harv. Collins (1909) describes a *Rhizoclonium tortuosum* but the diameter of the cells is given as 40–70 μ which obviously refer it to *Chaetomorpha*. Collins further remarks that it is synonymous with *Conferva tortuosa* in Ner. Bor. Amer. He also remarks that his species is not the same as *Rhizoclonium tortuosum* of Hauck (1885). I have seen and examined Harvey's specimen (Bot. Survey of Maine A 37. Herb. A. Young Jr. 1847) from which the plate and description of *C. tortuosa* was made and it is undoubted *Chaetomorpha tortuosa*. The cells are 46–64 μ, average diameter about 56 μ: they are barrel-shaped and 1½–3 times as long as broad. I have examined other specimens of Harvey's and they also belong to *Chaetomorpha*. Some of these plants, however, have perfectly straight walls and are not barrel-shaped. Reference has already been made to the fact that although the description of *Conferva implexa* Harv. refers to *Rhizoclonium tortuosum* yet one specimen from Harvey's collection under this name belongs to *Chaetomorpha tortuosa*.

I have compared specimens of *Chaetomorpha tortuosa* collected by myself at Carmel Bay with specimens from Phyc. Bor. Amer. collected from the same station but distributed as *Rhizoclonium tortuosum*. The two sets agree perfectly, the cells are large, 48–80 μ dia., average 66 μ, and 2–6 times as long as broad, average 2½–3½ times. The chloroplast is the typical dark green colour. Setchell and Gardner describe rhizoids (rare) but I could not find any in either their specimens or mine. It was this feature that presumably induced them to place their plants in the genus *Rhizoclonium*. This fact only serves to emphasise the nebulosity of the dividing line between *Chaetomorpha* and *Rhizoclonium*.

Hauck (1885) correctly describes *Chaetomorpha tortuosa* as having cells 40–100 μ dia., and 1–2 times as long as broad.

Rhizoclonium implexum (Dillw.) Kütz. *Conferva implexa* Dillw. Brit. Conf. p. 46 T. B. London 1809; C. Ag. Syst. Alg. p. 91 Lund 1824. *Rhizoclonium implexum* Kütz. Spec. Alg. p. 386. Leipzig 1849; Tab. Phyc. Vol. 3. T. 73. 3. 1853; Batters, List of the Marine Algae of Berwick on Tweed in Hist. Berwicksh. Natur. Club. Vol. 12. p. 230. 1890; Setch. and Gard. Mar. Alg. Pac. N. Amer. Part II, Chlorophyceae. Univ. Calif. Pub. Bot. Vol. 8. p. 183. 1920; Newton, L. Handb. Brit. Seaw. p. 93. London 1931. *Rhizoclonium rigidum* Gobi. Algenfl. Weiss. Meer. p. 85. St. Petersburg 1878; Foslie, M. Contrib. to Knowl. Mar. Alg. Norw. p. 142. Trömsö 1890. *Rhizoclonium riparium* var. *implexum* Rosenv. Grön. Haval. p. 915. 1893; Saunders, T. de A. Mar. Alg. Harrim. Expd. Proc. Wash. Acad. Scien. Vol. 3 p. 414. 1901; Setc. and Gard. Alg. N. W. Amer. Univ. Calif. Pub. Bot. Vol. 1. p. 222. 1903; Collins, F. S. Green Alg. N. Amer. Tufts Coll. Stud. Vol. 2 p. 328. 1909; Taylor, Mar. Alg. N. E. Coast N. Amer. Univ. Mich. Press, p. 82. 1937.

Exsiccatae: *Chaetomorpha tortuosa* Wyatt. Alg. Dan. No. 190. *Rhizoclonium rigidum* Nord. et Witt. No. 626 *pro parte*.

Both Stockmayer (1890) and De Toni (1889) include this species in *Rhizoclonium tortuosum*.

So far as can be ascertained, by this species is meant a form very like *Rhizoclonium tortuosum:* unbranched, free-floating, twisted, entangled, but of slightly smaller dimensions. The cells are usually described as 20–30 μ dia. rarely more, and 1½–2½ times as long as broad. The descriptions provided in most of the recent literature undoubtedly refer to this species but again the synonymy is difficult to unravel. Newton (1931) describes it as synonymous with *Conferva implexa* Dillw., *Rhizoclonium tortuosum* Kütz., and *R. rigidum* Gobi. No specimen of Dillwyn's was examined but it must be assumed that Harvey's *Conferva implexa* cannot be identical with Dillwyn's *C. implexa* because Harvey's plant is undoubted *Rhizoclonium tortuosum*. Dillwyn's *C. implexa* must therefore stand although the close similarity between the two species is strengthened by a comparison of Dillwyn's figures of *Conferva tortuosa* and *C. implexa*. These are depicted as being of almost the same dimensions and the only difference appears to be in the length of the cells which are somewhat shorter in *Conferva implexa*. Examination of many specimens shews that cell-length is a variable, unstable, and unreliable character.

I have collected specimens from Nova Scotia which agree with the description of this plant but differ from it in that very rare *septate*

rhizoidal branches may occur (cf. fig. 1). Rhizoidal branches when they do occur in *Rhizoclonium implexum* are always said to be aseptate. On the other hand the Nova Scotian plant did not have the abundance of branches that is a feature of *Rhizoclonium riparium*.

Setchell and Gardner have reported *R. implexum* from the Pacific coast of America. They consider Harvey's *Conferva implexa* to be identical with their plants but it is now clear that *Conferva implexa* Harv. = *Rhizoclonium tortuosum* (Dillw.) Kütz. They point out that Kützing's *Rhizoclonium implexum* is given a diameter of 11–12 μ which probably relates it rather to *Rhizoclonium Kerneri* Stockm. They note, too, that their plants agreed with Alg. Dan. No. 142 (*Conferva implexa*) and No. 190 (*Chaetomorpha tortuosa*). The former, however, has threads 35–45 μ and is *Rhizoclonium tortuosum*, whilst the latter has threads 20–27 μ dia. with occasional rhizoids and is true *Rhizoclonium implexum*. Foslie (1890) made the same error with respect to No. 142. *R. rigidum* Nord. et Witt. No. 626 is a mixture of two species. One is referable to *R. tortuosum* (cf. p. 5) whilst the other plant has threads of 20–24 μ dia. and must therefore be regarded as *R. implexum*.

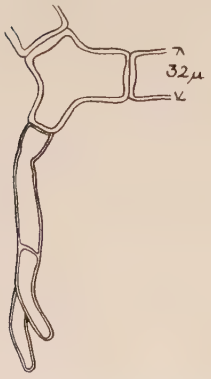


Fig. 1. Septate Rhizoid on plant of Rhizoclonium implexum from Nova Scotia.

B. Marsh forms of Fucus spiralis and Fucus vesiculosus

During a study of the algal flora of some New England salt marshes two marsh fucoids were collected which at first sight appeared to be similar but which, on closer inspection, exhibited certain differences. There appear to be only two principal records of marsh fuci in earlier literature. Farlow (1881) gives a poor description of a marsh form which has short fronds and is spirally twisted. This is named *Fucus vesiculosus* var. *spiralis*, and was distributed under this name in Phyc. Bor. Amer. by Holden. It cannot be known whether Farlow was describing a new form or whether he really believed it to be synonymous with *Fucus vesiculosus* var. *spiralis* (L.) Ag. This latter, however, has been shewn by Börgesen[1] to be identical with *Fucus spiralis* L. and *Fucus Areschougii* Kjellm. It is equally clear that the plant

[1] Journ. Linn. Soc. Bot. Vol. 39. 1909.

Farlow described was not *Fucus spiralis* L. and therefore it must be concluded that Farlow's nomenclature is erroneous. I have examined the plant distributed by Holden in Phyc. Bor. Amer. and agree with Sauvageau that it approaches nearest to *Fucus spiralis* var. *lutarius*. Taylor (1937)[1] retains it under the same name that Farlow employed but refers it tentatively to v. *volubilis* (Hudson) Turner.

In 1915 Johnson and York described a marsh fucoid from Cold Spring Harbor, Long Island, which they also named *Fucus vesiculosus* var. *spiralis*. They based this determination on the claim that they could get a complete series ranging from the attached plants of *Fucus vesiculosus* var. *spiralis* (*F. spiralis* L.). On the other hand they describe it as occasionally having vesicles, whereas the usual descriptions of *Fucus spiralis* L. (Newton, 1931) indicate that normal vesicles are entirely absent. The presence of vesicles suggests, therefore, that Johnson and York's plant was not derived from *F. spiralis* L. but from *F. vesiculosus*.

A number of marsh fucoids are known which are supposed to be derived from *Fucus vesiculosus*. Two marsh forms, *F. spiralis* var. *nana* Kjellm. and *F. spiralis* var. *lutarius* (Kütz.) Sauv., have been described and are said to be derived from *F. spiralis* L. Sauvageau (1908) remarks that he examined a specimen sent from America and he considered it to be var. *lutarius* and derived from *F. spiralis* L. In 1936 I collected plants from salt marshes at Scituate, Mass. in the *Spartina alterniflora* zone which have been compared very carefully with specimens distributed by Sauvageau,[2] and there seems little doubt that these plants are referable to *F. spiralis* var. *lutarius*. The fronds are normally much narrower than any of the large marsh forms of *Fucus vesiculosus* and there is a complete absence of vesicles. They agree fairly well with Kützing's (1860) figure of *F. lutarius*.

In the winter of 1935 I collected marsh fucoids from Cold Spring Harbor, Long Island, and here I found plants which were broader than those from Scituate and which possessed vesicles, and in one place intergrades could be found up to the normal plants of *Fucus vesiculosus* which is also present in the area. So far as can be seen, these plants do not differ in any way from the forms described by Baker and Blandford (1912) and named by them *Fucus vesiculosus*

[1] Mar. Alg. N. E. Coast N. Amer. Mich. Univ. 1937. p. 206.

[2] My thanks are due to Mr. Tandy for giving me access to these plants in the British Museum.

megecad *limicola* ecad *volubilis*. They also stated that the American form is no different from the British.

It now seems clear that there are two distinct marsh fucoids to be found on the coast of New England. Both have been described by earlier authors who have unfortunately misnamed them. A clear statement on the two forms and their synonyms is presented below.

Fucus vesiculosus megecad limicola ecad volubilis Baker.[1] "*Fucus vesiculosus* var. *spiralis*" auct. *non* Farlow. Johnson and York, 1915. Carn. Publ. 212; Collins, Rhodora, 1905. vol. vii; Taylor, Mar. Alg. N. E. Coast N. Amer. Mich. Univ. 1937. Pl. 25–45.

Fucus spiralis maritima minor Hudson, Flor. Angl. 1778. p. 577. [*Fucus volubilis*] Baker, S. M. *Journ. Linn. Soc. Bot.* 1912. vol. 40, p. 289. *Fucus vesiculosus* var. *volubilis* Turner, Syn. Brit. Fuci. vol. 1, 1802. *Fucus spiralis* var. *volubilis* Batters, *Journ. Bot.* vol. 40, 1902. *Fucus axillaris* var. *spiralis* J. G. Ag. Bid. Spets. Alg. in *Kong. Svensk. Vet. Akad. Handl.* vol. vii, 1868. *Fucus vesiculosus* megecad *limicola* ecad *volubilis*. Baker and Blandford, *Journ. Linn. Soc. Bot.* 1915, p. 352. Collected from marshes in Cold Spring Harbor, L. I.

Fucus spiralis var. lutarius (Kütz.) Sauv. "*Fucus vesiculosus* var. *spiralis*" Farlow, Mar. Alg. N. England, 1881, p. 101. *Fucus lutarius* Kütz. Tab. Phyc. Vol. X. 1860, p. 7 and tab. 17. *Fucus spiralis* var. *lutarius* Sauv. *Bull. Bord. Soc. Scien. d'Arcachon*. 1908, pp. 106–160, figs. 16–19.

Probably generally distributed along the marsh coast of New England and confined to low marsh dominated by *Spartina alterniflora*.

Caius College
Cambridge, England

PLANTS OF CENTRAL PENNSYLVANIA

Robert T. Clausen and Herbert A. Wahl

The basis for these notes is a trip made by us in early June, 1937, in some of the counties of central Pennsylvania. Report is also included concerning several other collections made in the summer of the same year. In the citation of specimens, our names are abbreviated as: *C*, R. T. Clausen, and *W*, H. A. Wahl. Specimens are deposited in the herbaria of the Bailey Hortorium and the Department of Botany at Cornell University, also in the herbarium of the Pennsylvania State College.

[1] " " = misidentification

Isoetes Dodgei A. A. Eaton (*I. riparia* var. *canadensis* Engelm.). Wipples Dam, 10 miles south of State College, Huntingdon Co., Aug. 20, 1937, *W* 274.

This is apparently the first record for central Pennsylvania. The specimens possess megaspores with jagged crests and leaves to 30 cm. long.

Isoetes Engelmanni A. Br. On muddy shore of stream, Ingleby, Centre Co., June 6, *C* & *W* 2535; partially and entirely submerged at edge of pond at Wipples Dam, 10 miles south of State College, Huntingdon Co., Aug. 20, 1937, *W* 273.

Leaves of these plants attain a length of 30 cm. Central Pennsylvania records seem lacking.

Asplenium Ruta-muraria ssp. **cryptolepis** (Fernald), n. comb. *A. cryptolepis* Fernald, Rhodora **30**: 41. 1928. Frequent on limestone rocks on west side of Spring Creek, Rock, north of Lemont, Centre Co., June 5, *C* & *W* 2526.

Review of the evidence presented by Fernald (1928) and of suites of American and European specimens lead to the conclusion that the Old and New World populations of the Rue Spleenwort are very closely related and should not be specifically segregated, since the characters upon which this separation is based seem not fundamental, nor can they be rigidly applied. That the American plant is rare, as stated by Fernald, is by no means borne out by field experience in northwestern New Jersey and parts of Pennsylvania, where it could only be rated as common. Some European specimens have the stipes mostly naked, as is usually the condition in American material. Although well developed European plants, particularly from the southern part of the range, are larger than American plants, most are small and of similar size. In our specimens, the stipes measure 1.0–6.0 cm. long and the fronds, 1.5–3.0 cm., with the segments 4–12, coming well within Professor Fernald's measurements for American plants, but some European specimens almost exactly reseumble these. Further, the teeth of our specimens are coarse, but bordered by a cartilaginous rim, as is supposed to be the condition only in Old World specimens. Examination of spores of the two supposed species reveals that, as Prof. Fernald has indicated, there is no difference in size, though there is a difference in the nature of the architecture of the spore-coat. In the European plants, the spores are considerably rough, almost jagged, while in the American plants, they are less coarsely roughened, but this tendency seems not of great systematic value. Since the

separation of the two populations must depend finally upon the scales of the rootstock and a tendency in size, it seems best to treat groups thus closely related, but geographically isolated and slightly differentiated, as subspecies.

Dryopteris Phegopteris (L.) C. Chr. Rich wooded slope at Rock View, Leolyn, Tioga Co., June 5, *C* & *W* 2518.

Cyperus Houghtonii Torr. A small colony on barren shaly hillside at Ingleby, 2 miles east of Coburn, Centre Co., Sept. 11, *W*.

This seems not to have been previously reported from Pennsylvania.

Carex prairea Dewey. Decidedly cespitose, forming large tussocks in rich alluvial boggy meadow, Centre Furnace, about 1 mile east of State College, Centre Co., June 7, *C* & *W* 2448.

Pennsylvania records seem significant, since the state is in the southern part of the range of this species as given by Mackenzie (1931–35).

Carex interior L. H. Bailey. Frequent in rich alluvial boggy meadow, Centre Furnace, about 1 mile east of State College, Centre Co., June 7, *C* & *W* 2557.

These plants appear typical, with ovate orbicular perigynia with short beaks. Like *C. prairea*, with which it occurs in association here, this species seems to reach its southern limits in Pennsylvania.[1]

Carex angustior Mackenzie, var. **gracilenta** var. nov., spicis disjunctis et foliis gracillimis et angustissimis, 0.2–1.0 mm. latis. Type in Gray Herbarium, cotypes at Bailey Hortorium and in herbaria of Cornell University and R. T. Clausen; moist woodland along stream at Ingleby, 2 mi. east of Coburn, Centre Co., June 6, *C* & *W* 2532. Besides the type, there may also be cited a collection (*W*) from 10 miles west of State College.

This differs from the typical variety of the species in the more lax and flexuous habit; in the longer inflorescence, 1.5–2.5 cm., with the 2–3 spikes rather remote; and in the very narrow leaves, which are from 0.2–1.0 mm. wide. Intermediate between this variety and typical *C. angustior* are specimens from a moist meadow 2 miles west of Richford, Tioga Co., N. Y., July 4, 1937, *C* & *S. J. Smith* 2631. These plants have the inflorescence 1.5–2 cm. long, with the spikes subremote. In the narrowness of the leaves and the slender habit, the collection of *E. Faxon*, no. 9, from Mt. Pleasant, N. H., resembles var. *gracilenta*, but it differs in having the spikes contiguous.

[1] Now reported by Core (Proc. W. Va. Acad. Sci. **11**: 36. 1938) from near Huntington, Cabell Co., West Virginia.

Carex Geyeri Boott. By limestone outcroppings, in dry deciduous woods on bluffs and slopes on west side of Spring Creek near west boundary of grounds of State Penitentiary, Rock, north of Lemont, Centre Co., June 5, *C* & *W* 2524.

Carex Geyeri grows on the bluffs along the west side of Spring Creek associated with *Asplenium Ruta-muraria* ssp. *cryptolepis*, *Carex oligocarpa*, and *Senecio obovatus*, in the shade of *Ostrya virginiana*, *Ulmus fulva*, and *Acer saccharum*. It was first discovered at this station in May, 1932, and has been under observation since that time. The possibility that this might represent an eastern representative of the section *Firmiculmes*, perhaps specifically distinct from *C. Geyeri*, has been considered, but all efforts to find satisfactory characters have failed. It was first thought that the Pennsylvania plants were more slender, with narrower leaves and slightly smaller perigynia, but large series of *C. Geyeri* from western North America indicate that the species there varies somewhat in habit and that the eastern plants come well within this range of variation. Although the habitat in Centre County seems natural and undisturbed, yet one may wonder whether the species is truly native there or has been introduced through the agency of man. We have no evidence to explain this unusual occurrence.

Carex Woodii Dewey. Rich wooded slope by Woodward Cave Woodward, Centre Co., June 6, *C* & *W* 2542.

This is reported only from the western part of Pennsylvania by Mackenzie (1931–35).

Carex laxiculmis var. copulata (Bailey) Fernald. Rich wooded slope by Woodward Cave, Woodward, Centre Co., June 6, *C* & *W* 2543; also rich woods, Rock View, Leolyn, Tioga Co., June 5, *C* & *W* 2512.

Instead of representing an extreme of *C. laxiculmis*, these collections seem more nearly intermediate between *C. digitalis* and *C. laxiculmis*, with the perigynia small, 2.6–2.8 mm. long, with staminate flowers borne at the bases of the fertile spikes, and with the leaves from 4–7 mm. wide.

Carex lasiocarpa ssp. **lanuginosa** (Michx.), n. comb. (*C. lanuginosa* Michx., Fl. bor. am. **2**: 175. 1803. *C. lasiocarpa* var. *lanuginosa* (Michx.) Kükenth in Engler, Das Pflanzenreich. **4**(20): 748. 1909.) Specimens with the leaves 1.5–3.5 mm. wide and the lowest pistillate spikes slightly peduncled, from rich alluvial boggy meadow, Centre Furnace, about 1 mile east of State College, Centre Co., June 7, *C* & *W* 2560.

Mackenzie and most other recent American students have maintained as species, *Carex lasiocarpa* and *C. lanuginosa*, basing this segregation largely on leaf-width, but also upon whether or not the lowest pistillate spike is peduncled, as well as on the condition of the beak of the achene. Certain intermediate specimens, as the collection of J. L. Edwards on June 27, 1936, from Succasunna, Morris County, New Jersey, led to a review of the material passing under the two names in the herbaria of Cornell University.

The Edwards plants were received as *C. lasiocarpa* and the extremes did represent that species, but the series revealed variations in leaf-width from the involute-filiform condition to flat and 2 mm. wide, and from having the lowest pistillate spike sessile or essentially so to possessing a stalk 2 mm. long. Examination of the available general series demonstrated that *C. lasiocarpa* ssp. *typica* definitely varies towards ssp. *lanuginosa*, while plants which have been passing as *C. lanuginosa* may be divided into two lots on a basis of leaf-width. The narrow-leaved phase (leaves 0.5–3 mm. wide), which seems intermediate between the broad-leaved form (leaves 2–4 mm. wide) and typical *C. lasiocarpa* (leaves 0.5–1.5(–2) mm. wide), seems to occur largely or almost entirely, in the area where the two so-called species overlap. South of this area, apparently only broad-leaved plants of *C. lanuginosa* occur, while north of it, and in northern Europe and Asia, typical *C. lasiocarpa* seems to be the only form represented.

Besides the leaf-character mentioned above, Victorin (1935) has employed the shape of the scale as basis for separation. He states that it is acuminate and aristate in *C. lanuginosa*, while it is acute or shortly aristate in *C. lasiocarpa*. In material, which on basis of width of leaf should be referred to *C. lanuginosa*, we found variation in the apex of the scale from acute to long-aristate, while in typical *C. lasiocarpa* we found the same range of variation. It has been stated by Robinson and Fernald (1908) that *C. lanuginosa* usually has the lowest spike peduncled, while all the spikes are sessile in *C. lasiocarpa*, but we have found specimens of the latter with the lowest spikes varying from sessile to possessing peduncles 2 cm. long, while specimens of the former may have the lowest spikes sessile or with peduncles from 1–50 mm. long. Other characters, such as length of lowest bract, employed by Mackenzie (1931–35), appear equally unsatisfactory.

Since few specimens from New York or New England are of the extreme broad-leaved form of ssp. *lanuginosa*, but many are inter-

mediate in character, they must be identified in a rather arbitrary fashion, because they appear slightly more one way than another. In the light of such a situation and in the absence of other good characters, it seems best to treat the broad-leaved race, which in North America is more southern and western than ssp. *typica*, as a subspecies of the collective species, *C. lasiocarpa*. The name of Michaux is employed for the broad-leaved race, despite the fact that the type is from the extreme northern limits of the range of this subspecies.

Carex Schweinitzii Dewey. Alluvial boggy meadow, Centre Furnace, about 1 mile east of State College, Centre Co., June 7, *C* & *W* 2559.

The pistillate spikes are 3–7 cm. long, with the lower perigynia rather remote and abortive. The staminate spikes often bear secondary spikes, sometimes with one pistillate flower at base, while the pistillate spikes are sometimes staminate at the apex. The variation in this material suggests the sort of instability that one might expect to find in a hybrid population. Besides the above collection, *C. Schweinitzii* has been reported elsewhere in Pennsylvania from Monroe and Susquehanna Counties by Porter (1903) and from Presque Isle, Erie County, by Bright (1925–30), but apparently no specimens from the state were available to Mackenzie.

Carex Frankii Kunth. Edge of woods in shaly soil beside path, Woodward Cave, Woodward, Centre Co., July 17, *W*.

Bright (1925–30) reports this species as being locally abundant in some southwestern counties. This station in Centre County is probably due to accidental introduction by tourists visiting Woodward Cave.

Amelanchier humilis Wiegand. Oak barrens southwest of State College, Centre Co., June 6, *C* & *W* 2552.

Phlox ovata L. Oak barrens 10 miles southwest of State College, Centre Co., June 6, *C* & *W* 2551.

Bailey Hortorium,
Cornell University, Ithaca, New York,
and
Department of Botany,
Pennsylvania State College, State College, Pennsylvania.

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ON CERTAIN PLANT RECORDS FROM HILLSBORO, NEW HAMPSHIRE

C. A. Weatherby and S. F. Blake

Since Mr. A. A. Beetle's recently published list of the vascular flora of the Fox Forest, Hillsboro, New Hampshire,[1] contains several reports of species not otherwise known from the region, it has seemed desirable to examine the specimens in the herbarium of the Forest on which, according to Beetle's preface, his records are based. Through the courtesy of the Director, Dr. Henry I. Baldwin, we have been able to make such an examination. Checking the herbarium against the published list discloses a considerable number of misidentifications. It seems unnecessary to publish a full list of these in Rhodora, since in the great majority of cases the species concerned are unquestionably present or likely to occur in the Fox Forest or its vicinity, although the specimens on which their presence in the list depends are wrongly named. In the interest of accurate phytogeography, however, some of the reports should be corrected, particularly those of calcicolous species not to be expected in the hill country of southern New Hampshire. The list of such errors follows. Author citations are given only for names not in current manuals.

Cystopteris bulbifera. Not known in southern New Hampshire. The Fox specimen is *Dennstaedtia punctilobula.*

Selaginella apoda. This might occur at Hillsboro, but the specimen is a moss.

Triodia flava (L.) Smyth. Known in southern New Hampshire only from the Merrimac valley. Specimens are a mixture of *Agrostis alba* and *A. tenuis.*

Carex diandra. Known in New Hampshire only in Coös County. Specimen is young *C. stipata.* Mr. Beetle himself made this correction on a duplicate sheet in the herbarium of the New England Botanical Club, but apparently too late to get it into the list.

[1] Beetle, A. A. Flowering Plants and Ferns of the Fox Research Forest, Hillsboro, New Hampshire. Caroline A. Fox Research and Demonstration Forest, Bull. no. 9. 40 pp. Concord, N. H., 1938.

Carex triceps, var. *hirsuta*. Not known from New Hampshire. Specimen is *C. virescens*, var. *Swanii*.

Eleocharis intermedia. Known in New Hampshire only at a single station in Coös County. Specimen is *E. obtusa*.

Juncus Dudleyi. Known in New Hampshire only in calcareous areas in Coös County and at Bath and Sumner's Falls in the Connecticut valley. Specimen is *J. macer* S. F. Gray (*J. tenuis* of manuals).

Oxalis corniculata (*O. repens* Thunb.). This record has apparently resulted from an unsuccessful attempt to correct the erroneous nomenclature of Gray's Manual, seventh edition. The specimen was originally, and correctly, identified as *O. corniculata* of the Manual (= *O. europaea* Jord., which is also given in Beetle's list). But the addition of the synonym *O. repens* Thunb. transfers the record to true *O. corniculata*, a southern species known in New England only as a weed in greenhouses and an occasional and temporary escape outside.

Euphorbia humistrata. Known in New England only from reports of its occurrence at St. Johnsbury and Woodstock, Vermont. No specimen was found. The species might, of course, have been introduced at Hillsboro; more probably the report rests on *E. maculata*, which is not included in Beetle's list.

Viola striata. Not known from New England; as pointed out in Conn. Geol. and Nat. Hist. Surv. Bull. xiv. 427, the report from Connecticut in Bishop's Catalogue is founded on highly dubious data. The Fox specimen is *V. conspersa*.

Lonicera oblongifolia. Apparently does not occur in New Hampshire. Specimen is × *L. bella* Zabel, a rather frequent escape from cultivation.

On the other hand, the list and the herbarium contain the following authentic records of considerable local interest.

Arisaema Dracontium. The specimen, collected in Hillsboro, June, 1935, by H. I. Baldwin, constitutes the first record for the species known to us east of the Connecticut valley.

Pycnanthemum incanum. Not in the list, but in the herbarium is a specimen, originally identified as *Mentha arvensis* var. *canadensis*, labelled "infrequent in shady clearings, Fox Forest, Aug., 1936. Coll. A. A. Beetle." There is no material of the species from New Hampshire either in the Gray Herbarium or that of the New England Botanical Club. Jesup (Cat. Fl. Pl. Hanover 32 (1891)) reports a single collection of it from Claremont and F. W. Batchelder (Proc. Manchester Inst. iv. pt. 2, 39 (1909)) states that it is "common" about Manchester—a change from the "not common" of his first edition hardly justified by the experience of later collectors in the region. In any case, the species is not common in the hill country and its occurrence at Hillsboro is worth mention.

Ampelopsis brevipedunculata Koehne, var. *Maximowiczii* (Regel) Rehder. If really spontaneous, the occurrence of this east-Asiatic

plant at Hillsboro is worthy of record. It is not in the list; the herbarium label refers to it as a "common roadside vine." We fear, however, that this statement refers rather to *Vitis Labrusca*, as which the specimen was determined, than to the *Ampelopsis*.

Senecio obovatus. We know of no previous record of this species from New Hampshire, though there are isolated stations for it in northeastern Massachusetts and in southeastern Vermont.

Gray Herbarium and
United States Department of Agriculture

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